# Union Switch & Signal Inc.

# 1999 Product Catalog

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# General Information

## Introduction

This catalog is designed for those persons involved in the design of circuits and systems for railway signal and control systems and all those who may at anytime be involved in ordering signalling materials such as purchasing, storekeeper, and maintenance personnel.

The catalog covers the complete standard line of US&S manufactured equipment. However, no attempt has been made to cover all the variety of equipment such as that required for highly specialized or customized applications.

The equipment featured in this catalog has been manufactured using the latest production and technological techniques with emphasis on quality, reliability, and serviceability.

## Major Categories / Sections

The products shown in this catalog have been arranged by major product categories/sections that are identified by generic name rather than style or type designation. This approach has been employed to insure maximum utility from the user's viewpoint. A list of the major categories follows:


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|---|---|
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| **Section 2** | Electronics |
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## Explanation of Ordering System

A numbering system has been instituted as a means of establishing the sequence of the sections within the catalog. There are three basic divisions in this numbering system: 1) General Section/Category, 2) Product group, 3) Page number within that particular product group. An explanation of this system follows:

1. On the top outside corner of each page, there is a series of alphanumeric characters in red, this is the functional page number. [(i.e. 4B(3)]

2. The first number identifies a major product category/section (Example, 2 for Electronics, 8 for Relays, etc.) as well as the physical location within the catalog (Section 1 being at the front and 10 being at the rear).

3. The product group under each major category is designated sequentially by alphabetic letters in caps. For example, 4B, is the second product group under the fourth major product category/section.

4. The third character is a number in parentheses indicating the page number within that particular product group. For example, 4B(3), would indicate the third page of the second product group of the fourth major category.

## Ordering and Sales Support

Union Switch & Signal's Sales Center in Batesburg, South Carolina, is the place to go for all your standard product and component parts orders. Our Batesburg staff is highly experienced in order processing for every type of US&S product or component, from switch machines to the smallest circuit board electronic components. The staff is supported with advanced computer programs that speed new orders into the system and provide fast, accurate and in-depth data on orders already in the pipeline.

Our Batesburg plant is also the place to call for US&S's array of product and component service programs. For products, parts or service, call our Batesburg Sales Center during regular business hours at 1-800-652-7276.

## Ordering Information

Product orders from this catalog may be phoned in or mailed to US&S.

1. If ordering a spare or replacement unit for an in-service installation, check your US&S part number reference for that unit before placing the order.

2. Check the most current release of Union Switch & Signal's Price List for the part's price.

3. Indicate the order (part) number, unit price, product name and/or model number.

4. If ordering a product for a new installation, please provide any additional information, such as operating specifications, that may be helpful in confirming the correct product for that installation.

- Send mail orders to:

  Union Switch & Signal Inc.
  Sales Center
  645 Russell St.
  Batesburg, SC 29006

- Phone orders to US&S at **1-800-652-7276**. Call this number to check on the status of an in-process order.

# Terms and Conditions

All sales of goods by us are made solely upon the following terms and conditions as well as any additional terms and conditions that appear on the face of any quotation or order acknowledgment issued by us.

1. ORDERS: A binding contract will be formed only when your order is accepted in whole or in part by us. Terms and conditions on your order from at variance with or in addition to terms and conditions stated herein are binding upon us only if specifically accepted by us in writing. Your assent to these terms and conditions, and to the terms and conditions contained in our acceptance of your order, shall be presumed conclusively from your failure to object in writing within 30 days after receipt of our acceptance or from your acceptance of all or part of the goods hereunder. After acceptance, you may modify or cancel your order only upon written notice and payment to us of our costs resulting therefrom. Any order amounting to less than $50.00 will be billed at $50.00.

2. PRICE: Unless otherwise stated prices are net F.O.B. our factory, exclusive of transportation and insurance, and are firm for thirty (30) days. Shipments will be billed at prices in effect on the date that we accept your order. Published prices are subject to change without notice and quoted prices are subject to adjustment if specifications or delivery requirements are changed after price is quoted.

3. TERMS OF PAYMENT: Unless otherwise stated, all invoices will be rendered when goods are shipped and are due and payable net thirty (30) days from date of invoices. For each thirty days, or part hereof, that an invoice remains overdue, you will be charged interest on the unpaid balance at a rate not exceeding the maximum lawful rate. Partial shipments may be made at our option. If all items are not shipped on the same date, pro rata invoices will be rendered. If engineering design is part of the order monthly progress payments will be required.

Unless you have an established credit rating with us, cash must accompany your order or shipment will be COD. Our determination of your financial responsibility will be final.

If you are responsible for any delay in shipment, the date of completion of goods may be treated by us as the date of shipment for purposes of payment. Completed goods shall be held at your cost and risk and we shall have the right to bill you for reasonable storage and insurance expenses.

4. TAXES: Prices exclude all duties, taxes or other governmental charges which now are or hereafter may be imposed upon the sale or use of the goods herein. Any such taxes or other charges paid by us shall be for your account and shall be added to the prices set forth herein. Any exemption claimed from the application of such taxes or charges should be plainly designated on the face of the orders with us and accompanied by exemption certificates where the law so requires.

5. DELIVERY: Shipment, delivery, and installation dates are estimated dates only, and unless otherwise specified, are calculated from the date of receipt of complete technical data and approved drawings, as appropriate. In estimating such dates, no allowance has been made, nor shall we be liable directly or indirectly for delays of carriers or delays from labor difficulties, shortages, strikes or stoppages of any sort, fires, accidents, failure or delay in obtaining materials or manufacturing facilities, acts of government affecting us directly or indirectly, bad weather, or any cause beyond our control or causes designated Acts of God or force majeure by any court of law and when such delays arise, the estimated delivery date shall be extended accordingly. We will not be liable for any damages or penalties whatsoever, whether direct, indirect, special or consequential, resulting from our failure to perform or delay in performing unless otherwise agreed in writing by an authorized officer or his designee.

The date of delivery is the date of delivery by us to the initial carrier and as of this date, risk of loss is transferred to you. You are solely responsible for claims for loss or damage in transit. Claims for errors or shortages in shipments must be submitted to us, with adequate substantiation within thirty (30) days after receipt.

6. TITLE: Except as otherwise agreed in writing, title to the goods or any part thereof shall pass to you as soon as all payments due have been fully made in cash. The goods shall be and remain personal or movable property, notwithstanding their mode of attachment to realty or other property. If default is made in any of the payments, we may retain all payments which have been made on account of the purchase (up to 30% thereof) as liquidated damages, and we shall be entitled to the immediate possession of the goods and shall be free to enter the premises where the goods may be located and remove them, without prejudice to our right to recover any further expenses or damages which we may suffer by reason of non-payment.

7. SOFTWARE: We hereby grant you a non-exclusive, non-transferable right to use the software (which shall mean and include programs, data base and related technical documentation), if any, which may be furnished by us with, or may be incorporated in, the goods supplied hereunder. The software is proprietary information which you shall keep confidential. You shall assist in protecting the software by permitting inspection of any location where the software is used or kept and by notifying us promptly upon discovering unauthorized possession, use or knowledge of the software.

The software may be used only in accordance with our instructions and with the goods supplied hereunder, and may not be decompiled, copied or modified without our prior written approval.

The license granted hereby shall remain in force until the use of the goods supplied hereunder ceases, or until terminated by written notice for your failure to perform any obligation hereunder, your attempt to transfer this license or your insolvency or bankruptcy. Upon termination, you shall immediately cease using the software and return the software to us.

7. WARRANTY: Items of equipment and parts manufactured by us are warranted to conform to our published specifications and to be free from defects in workmanship and material under normal and proper use and service. We will repair or replace, at our option and expense, and return to you, F.O.B. our factory, transportation charges prepaid, any such item or part which breaches this warranty within one (1) year after shipment to you provided that you

promptly give notice to us of such breach, return such item or part to us, transportation charges prepaid, with a completed "Return Material Authorization," and upon examination we confirm said breach. Items of equipment and parts manufactured by others and furnished by us are warranted only to the extent of the original manufacturer's warranty.

System designs and software (if any) furnished by us for this order are warranted to conform to our published specifications therefor or to the technical description prepared by us for this order. We will correct at our expense any defect in said design or software that results in a breach of this warranty under normal and proper use and service within one (1) year after first placing the design or software in service provided that you promptly give written notice to us of such breach and you can recreate, under actual operating conditions, the condition which constitutes the alleged breach.

All warranties shall be void and we shall not be responsible for any item, part, design or software that, after shipment or installation, is altered, tampered with, or repaired by anyone except personnel authorized by us; that is used under conditions varying materially from existing industry standards; that is damaged or fails to operate properly due to abrasion, corrosion or the influence of foreign energy or matter; or that proves unsuitable in an application of your choosing or a system of your design.

Any item, part, design or software which is repaired, replaced or corrected hereunder is warranted only for the remainder of the original warranty period. If repair, replacement or correction of a part of an item, design or software eliminates a warranty related problem, then the item, design or software will not be condemned hereunder.

The foregoing obligations are expressly in lieu of all other warranties, guarantees, obligations or liabilities, express or implied by statute or otherwise. IN PARTICULAR THERE SHALL BE EXCLUDED THE IMPLIED WARRANTY OF MERCHANTABILITY AND THE IMPLIED WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE. We shall not in any event be liable for the cost or expense, including labor, in connection with removal or reinstallation; for indirect, incidental or consequential damages of any kind; nor for any claims arising out of the supply or use of items, designs or software furnished hereunder, except as set forth herein.

8. REJECTIONS/ RETURNS/ CANCELLATIONS: Goods may be rejected for cause only if you notify us in writing within thirty (30) days after delivery. Failure to provide such notification constitutes acceptance of the goods. Only orders for standard goods may be canceled and only standard goods may be returned.

No goods may be returned more than 30 days after the date of delivery except with our written consent. An order for standard goods may be canceled prior to delivery and, if the box, container or packaging is unopened, standard goods may be returned within 30 days after delivery, subject to a cancellation charge of 15% of the order value. If the box, container or packaging has been opened, standard goods may be returned within 30 days after delivery, subject to a cancellation charge of 25% of the order value.

9. PATENTS: We will indemnify you from claims, suits, or actions by third parties that any item, or any part thereof, sold by us to you in and of itself infringes any United States patent if within thirty (30) days you notify us in writing of any such claim and give us authority, information, and assistance (at our expense) to dispose of such claim, and to defend any suit that may be brought against you thereon. In that event we will, at our expense, defend any such suit and satisfy any judgment therein to an amount not exceeding the price paid us for said item held to infringe. If, in any such suit, an injunction is issued against the further use of said item or any part thereof, we will at our option and expense, either procure for you the right to continue using said item or will (if you give, at our expense, such assistance as may be reasonably requested) replace the same with non-infringing items or modify it so that it becomes non infringing or remove said item and refund the purchase price and the transportation and installation costs thereof. The foregoing expresses all of our obligations and liabilities as to patents.

10. INSPECTION AND TESTS: Inspection of goods in our plant by you or your representative will be permitted provided this does not interfere with production and details of the proposed inspection are submitted to us in writing in advance. Goods and components thereof will be tested in accordance with our standard quality assurance procedures. If acceptable to us, additional tests may be conducted at your expense.

11. SPECIAL JIGS, FIXTURES AND PATTERNS: Unless supplied by you, any jigs, fixtures, patterns, design engineering and the like which are used for your order will remain our property without credit to you. We will have the right to discard and scrap them after they have been inactive for one (1) year without credit to you provided that you are given notice and opportunity to buy them before discarding or scrapping.

12. RECORDS, AUDITS AND PROPRIETARY DATA: Unless otherwise specifically agreed to in writing signed by an authorized officer, neither you nor any representative of yours, nor any other person shall have any right to examine or audit our cost accounts, books or records of any kind or on any matter, or be entitled to or have control over any engineering or production prints, drawings or technical data which we, in our sole discretion, may consider in whole or in part proprietary to ourselves.

13. APPLICABLE LAW: The rights and duties of the parties shall be governed by the laws of the State of South Carolina.

# Service Policy

## General

We recognize that continuous effective operations is an on-going challenge to our customers. Following are descriptions of various services we offer to aid you in meeting this challenge. However, should you have a unique service requirement, we can work with you and design a custom service program tailored to your individual needs.

## Warranty Repair

Our products are warranted to perform to our published specifications and to be free from defects in workmanship and material under normal and proper use and maintenance. We will repair or replace at our expense any item or part that breaches this warranty during the warranty period specified for the product. To use this service, simply call our toll-free number at **1-800-652-7276** and ask for our Service Shop.

## Relay and Ground Equipment Remanufacturing Service

We don't just refurbish our relays and ground equipment; our remanufacturing process returns to you a product of "like new" quality that we back with a "like new" warranty of one year.

With our ground material remanufacturing service, we use only original replacement parts when required, and each product is remanufactured to meet its original functional specifications.

## Repair and Return Service

"After Warranty" repair may be obtained on a repair-and-return basis. For this service, simply call our toll-free number at **1-800-652-7276** and ask for our Service Shop. Typically, such repairs are made in 30 days or less after receipt.

## Inspection Services

We can help you maintain the safety and integrity of your signal equipment by performing the Federally mandated and manufacturer-recommended periodic inspections of your equipment. We offer a low-cost, through-the-mail inspection service for relays as well as on-site inspection of large volumes of relays and other signal equipment.

## Field Service

For those instances when equipment or system servicing is best carried out at the customer's site, we are staffed with experienced engineers and service personnel to provide this capability. See the most recent version of the US&S Price List for hourly rates of engineers and service technicians.

## Returned Material Authorization (RMA) Procedure

Use of the following Return Material Authorization Procedure will enable you to return malfunctioning equipment (not covered by an Advance Exchange repair program) to Union Switch & Signal, Inc.. Following this procedure will help prevent processing errors, shorten the repair cycle and may eliminate the need for return.

1. Obtain the following information:
   -Serial number of failed unit
   -Part number of failed unit
   -Unit description
   -Complete description of failure symptoms

2. Call US&S's Service Shop at **1-800-652-7276**

3. Request an RMA number.

4. Provide the following information to our Service Representative:
   -Your name
   -Company
   -Information from item #1 above
   -P.O.# (for non-warranty items)

5. Properly pack the failed unit for shipment

6. Write the RMA number on the outside of the shipping carton (ATTN: "RMA NUMBER") and ship the unit (freight prepaid) to:

**Union Switch & Signal Inc.**
**Service Shop**
**645 Russell Street**
**Batesburg, SC 29006**

# Union Switch & Signal Inc.

## General

Union Switch & Signal Inc. has been the internationally recognized leader in railway signalling automation and control for more than 100 years. The company is a leading manufacturer of high quality relays and timers, track circuit control and ground equipment, switch machines and switch support equipment, all manner of wayside signals, all types of classification yard control and ground equipment, carborne detection, control and display equipment and the full range of highway crossing devices. In every product area, US&S has made notable technological advances, in particular, new solid-state and software-controlled devices that greatly reduce hardware requirements and operating costs over traditional equipment designs.

US&S complements its exceptional product design and manufacturing capabilities with equivalent expertise in systems integration. US&S mainline, transit and classification yard control systems manage tens of thousands of vehicle and train operations per day over hundreds of thousands of track miles. This achievement is made possible by a highly trained team of engineers and project management specialists who are masters of railway system design and implementation.

US&S is also geared to provide extensive after-sale support of its products and systems. Its service programs ensure maximum productivity from in-service equipment, while its training programs develop maximum user proficiency in the set-up, operation and care of this equipment. US&S serves railway properties around the world, and every mainline and transit property in the United States. Our international operations are supported by facilities and representatives worldwide.

*Union Switch & Signal Inc.'s corporate headquarters and Systems and Research Center is located in Pittsburgh, Pennsylvania*

## Note

This catalog is intended as a reference guide for the company's component and subsystem products. Every effort has been made to make this catalog informative and user friendly. For more information on large scale project engineering and management, or subjects not covered in this catalog, please call any of our toll-free numbers and you will be directed to the appropriate person.

*US&S Manufacturing and Service Center - Batesburg, South Carolina*

UNION SWITCH & SIGNAL

## Centralized Traffic Control
*(Mainline & Transit)*

- Territory Consolidations
- Territory Displays
- Computer-Aided Dispatching
- Translation Software
- Office/ Field Interface
- Mainline and Transit

## Classification Yard Control
*(Office Logic and Yard Ground Equipment)*

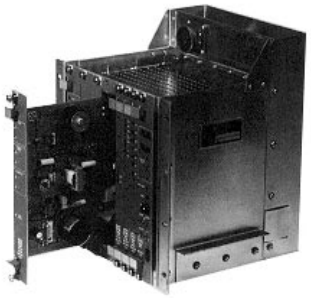
- Computerized Yard Office
- Hump Operator Displays
- Calibration Software
- Hump Locomotive Control
- Bowl Area Ground Material
- Mainline and Transit

## Wayside Signalling Logic

- Vital Interlocking Controllers
- Non-Vital Logic/ Comm. Interface
- Office/ Field Code Translation
- Track Circuits (Coded, AF, AFO)
- Power Supplies and Protection
- Mainline and Transit
- Electrified and Non-Electrified

## Wayside Signalling Ground Equipment

- Switch Machines
- Signals
- Impedance & Mini-Bonds
- Wheel Detectors
- Train Stops
- Mainline and Transit



## Carborne Equipment
### *Cab Signalling*

- ATP, ATC, ATO
- Control Logic
- Aspect Displays
- Crew Acknowledge Devices
- Track Receivers, Axle Generators
- Mainline and Transit

## Carborne Equipment
### *End-Of-Train*

- 2-Way
- Last Car Telemetry
- Cab Display
- Test Equipment

## *Highway (Grade) Crossing Equipment*

- Detection Circuits
- Gate Mechanisms
- Gate Arms
- Flashing Lights
- Cantilevers
- Signs and Bells
- Power Supplies

## *Repair and Remanufacturing Services*

- Solid-State Systems
- Relays
- Carborne Equipment
- Ground Material
- Advanced Exchange
- Remanufacturing
- Factory and Field

UNION SWITCH & SIGNAL

# Important US&S Addresses and Phone Numbers

## Corporate Headquarters and Systems & Research Center

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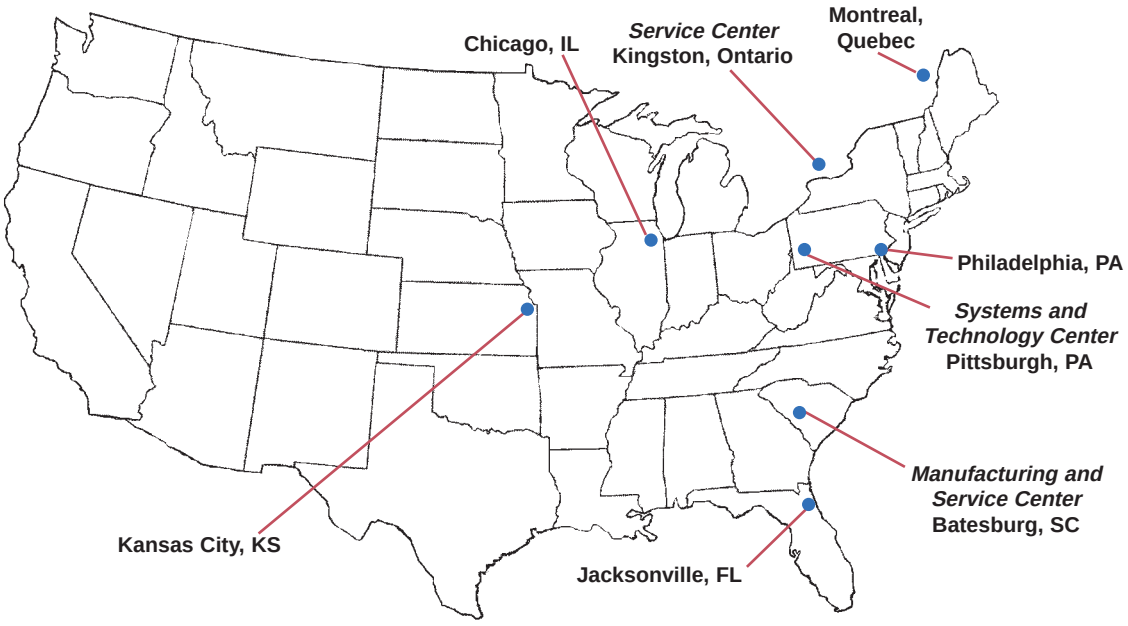
Fax (913) 438-8415
Toll-Free (800) 889-8679

# Sales and Service Support




Union Switch & Signal's Sales Center in Batesburg, South Carolina, is the place to go for all your standard product and component parts orders.

Our Batesburg staff is highly experienced in order processing for every type of US&S product or component, from massive switch machines to the smallest circuit board electronic components.

The staff is supported with advanced computer programs that speed new orders into the system and provide fast, accurate and in-depth data on orders already in the pipeline.

Our Batesburg plant is also the place to call for US&S's array of product and component service programs. For products, parts or service, call our Batesburg Sales Center during regular business hours at **1-800-652-7276**.

## R.A.I.L. Team

*Rapid Action Information Link (R.A.I.L.) Team*

US&S customers can call toll-free, 24-hours a day, seven days a week, to get timely and accurate answers to technical questions from one of our R.A.I.L. Team members.

This dedicated and experienced team of product and application engineers will work with you to resolve any technical issues concerning US&S products and will not stop until you are satisfied with our response.

All you need to do is call the R.A.I.L. Team toll-free at
**1-800-652-7276**
and ask the operator to connect you with a R.A.I.L. Team member.

# MICROTRAX® Coded Track Circuit System

## Features

- Extremely long Track Circuits
- High immunity to interfering signals
- Up to 20 user track codes
- On-site parameters set up with portable PC
- User-programmable application software
- Advanced diagnostics
- Interfaces to MICROLOK or relay interlocking

## Ordering Information

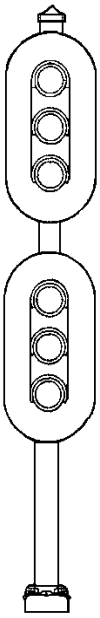
Refer to Pages 2A(4-6).

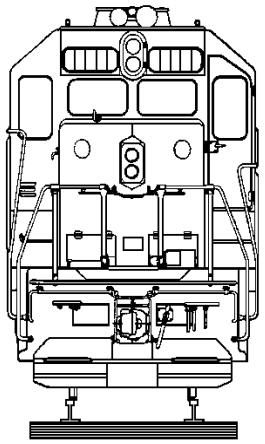
## General

The MICROTRAX Coded Track Circuit System combines train detection with the communications capability of a 4-wire HD line circuit. All data is transmitted through the rails, with a single MICROTRAX unit capable of controlling the adjacent ends of two track circuits at an intermediate location, or linking an end track circuit to an interlocking control system. The system responds to a broken rail or faulty insulated joint as a shunt condition. For maximum traffic throughput, an optional Quick Shunt Module is available. This module gives the system the same 1/4 second or less shunt response time as a relay-based track circuit. Twenty codes are available for standard line circuit functions such as clear block and lamp out, and for special functions such as remote switch control.

Codes are coupled to the rails through a heavy duty Track Interface Panel that terminates the track at a very low impedance to the frequency components of the track code. This feature allows exceptionally long track circuits, and makes the MICROTRAX system compatible with wide-band terminating shunts. A high impedance is also created at 150 Hz and higher frequencies, making the MICROTRAX system equally compatible with railway crossing motion and predictor equipment, without need of external blocking units.

Signal lamp driving capabilities standard with the MICROTRAX system include direct drive of colorlight and searchlight signals, “soft” turn-on of lamps, adjustable output voltage, 6-wire searchlight control, stuck searchlight mechanism detection, and filament checks. Soft lamp turn-on minimizes battery drop by limiting in-rush current. This feature increases lamp life and prevents shut-downs from below-tolerance battery levels. Signal head voltage is conveniently adjusted on the MICROTRAX front panel; a computer-calculated display gives the proper current





MICROTRAX®
CODED TRACK CIRCUIT SYSTEM

for the user's circuits. Built-in lamp voltage calibration eliminates having to select and install dropping resistors in the signal circuits.

The MICROTRAX system automatically shuts down in the event a burned out searchlight lamp or stuck mechanism is detected. With a burned-out color lamp, the system can be programmed to downgrade according to the railroad's lightout scheme. At an end (control) point location, the MICROTRAX system can be readily interfaced to US&S's MICROLOK PLUS interlocking controllers (via serial link) or a relay interlocking. The unit also provides an inexpensive means of cross lighting signals on double-track right-of-way.

## Design Highlights

***Programming***

The MICROTRAX unit can be precisely configured for the user's application on several operational levels. System-level functions such as general location type (e.g. intermediate, repeater) are defined with the MICROTRAX Development System. This user friendly hardware/software package enables the application logic to be written in familiar wayside logic terms; no background in computer programming is required. Application logic development is also available as a service from US&S.

Site-specific details such as unit ID, track operating parameters and numbers of signal heads are set up on-site with a lap top PC that plugs directly into the MICROTRAX unit. Set-up data is stored in an erasable EEPROM that is separate from the unit's CPU module, making this module a standard, interchangeable component between all MICROTRAX units (the only transferred component is the system application EPROM).

***Unit Layout***

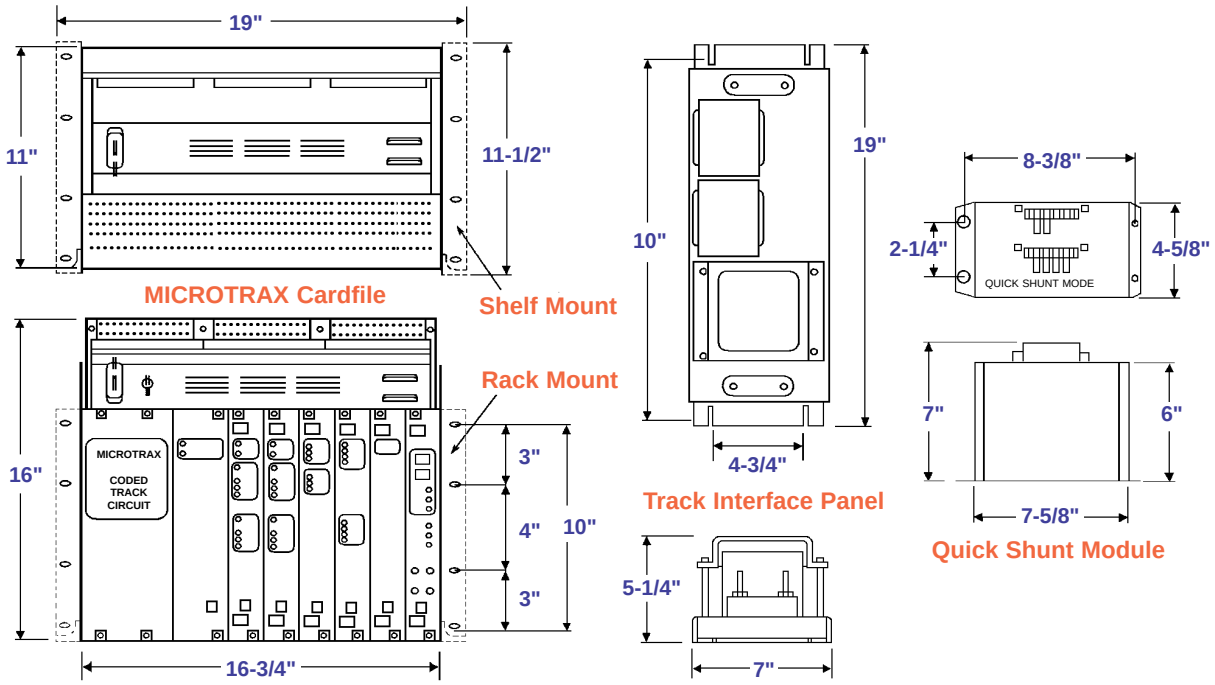
All MICROTRAX switches and displays are easily accessed on PCB front-edge control panels. Included are two alphanumeric LED displays that assist with on-site and diagnostics. Discrete LEDs give a snapshot of all inputs, outputs, and key internal functions.

Except for power input, all local wiring to the MICROTRAX unit is plug connected to allow rapid change out of units. Dielectric mounting channels on the cardfile inhibit any transient electrical currents.

***Power Usage***

The typical intermediate location MICROTRAX unit draws less than 1 amp of current (lamp drive extra). The MICROTRAX unit avoids premature loading of a recharging battery by starting at 11.5 Vdc.

A "Sleep Mode" option is available for light traffic installations, greatly reducing current draw when track circuits are inactive. As a result, remote MICROTRAX units can be solar powered with a relatively small, low-cost solar array.



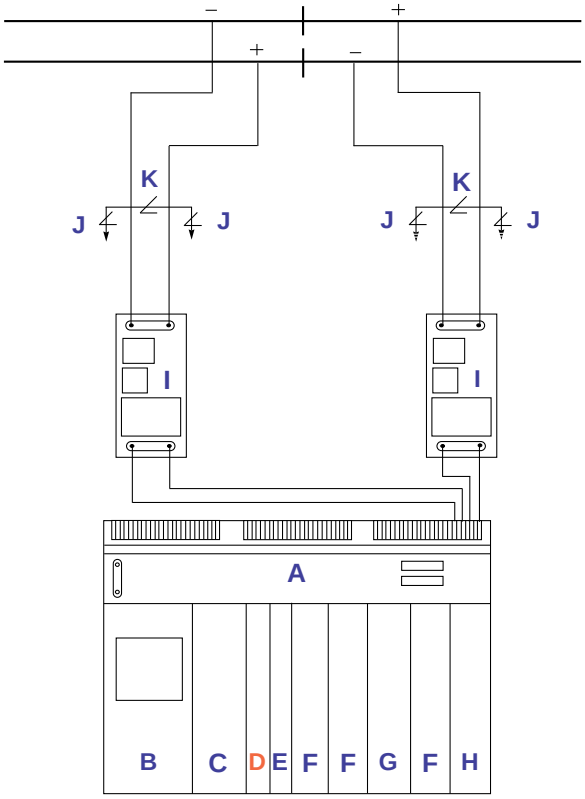

## Specifications

| | |
|---|---|
| ***Unit Dimensions*** | See Diagram above |
| ***Unit Weight*** | Cardfile: 30 lbs. Track Unit: 45 lbs. Quick Shunt Module: 4 lbs. |
| ***Power Input*** | 9.8 - 16.2 Vdc |
| ***System Start*** | 11.5 Vdc |
| ***Ripple*** | 0.5 VP-P (max.) |
| ***Current*** | Steady State: 1.0 A + lamp load |
| ***Required Charger*** | Constant voltage type |
| ***Short Circuits*** | I/O withstands continuous short circuits (software dependent) |
| ***Circuit Breaker*** | 15A |
| ***Lamp Drive*** | 18W or 25W, 10V lamps |
| ***Lamp Adjust*** | 8.5 - 12.4 @ 13V battery (one-unit potentiometer) |
| ***Power Output*** | Isolated 12V dc (contact state of remote equipment, e.g. switch machine AFO) |
| ***Vital Kill Relay*** | US&S PN-150B |
| ***Vibration*** | 1.0G RMS, 0.2" displacement, 5-1000Hz |

| | |
|---|---|
| ***Track Circuit Length*** | Up to 22,000 ft. @ 3 ohms / 1000 ft. ballast |
| ***Shunt Response*** | Standard detect: 6 - 12 sec.<br>Standard and quick clear: 12 - 18 sec.<br>Quick detect: 100 msec.<br>Application logic dependent |
| ***Track Codes*** | 22 Codes (max.) |
| ***Track Inductance*** | 10, 15, 20 or 40 mH |
| ***Foreign Current Immunity*** | 0.25A DC, 20V RMS - 60 Hz rail-to-rail |
| ***Lamp Driver Outputs*** | 2 signal heads per module<br>0, 1 or 2 modules |
| ***Isolated Inputs*** | 2 each on color & searchlight modules<br>4 inputs (max.) on isolated I/O module |
| ***Isolated Outputs*** | 2 outputs (max.) on Isolated I/O |
| ***Non-Isolated I/O*** | 4 inputs per module (max.)<br>4 outputs per module (max.)<br>0, 1 or 2 modules in place of lamp drivers |
| ***Local I/O Wiring*** | 22-way connectors |
| ***Serial Data Ports*** | EIA RS-232C compatible (25-pin) |
| ***On-Site Program*** | IBM-PC compatible, DOS |

UNION SWITCH & SIGNAL

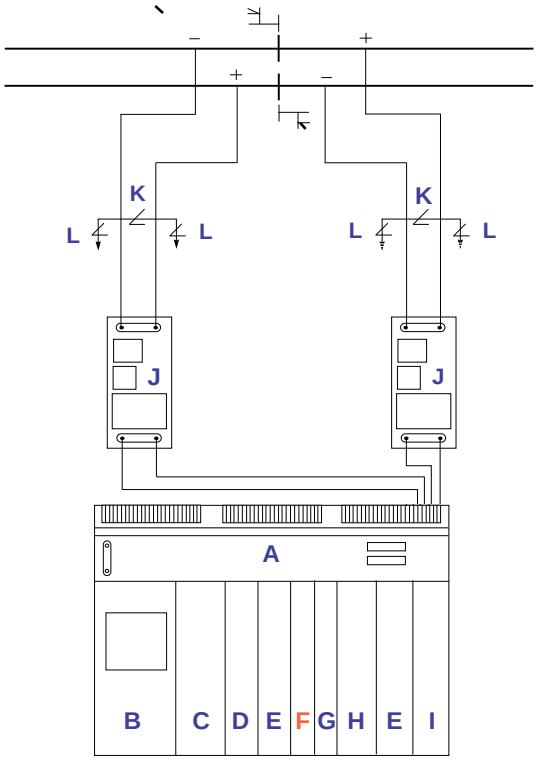
# Typical MICROTRAX
# Coded Track Circuit Equipment List




| Letter | Part Description | Part Number | Quantity |
|---|---|---|---|
| **A** | Coded Track Cardfile | N451812-4101 | 1 |
| **B** | Blanking Plate (6.69”) | N451910-1101 | 1 |
| **C** | Power Supply | N166003-01 | 1 |
| **D*** | Non-Isolated Module for 12-Volt Relay | N451910-6601 | 1* |
| **E** | Blanking Plate (0.75”) | N451850-2902 | 1 |
| **F** | Blanking Plate (1.55”) | N451850-2901 | 1 |
| **G** | Track Interface Module | N451910-0701 | 1 |
| **H** | CPU Module | N451910-0103 | 1 |
| **I**** | Track Interface Panel | N451835-0101 | 2 |
| **J** | Arrestor | N451552-0201 | 4 |
| **K** | Arrestor | N451552-0101 | 2 |
| **L***** | Cardfile Brackets | X451812-4102 | 1 |
| **M***** | PN-150 Relay | N322500-701 | 1 |

*Non-isolated module required if driving local 12-volt relays or receiving inputs. If not required, substitute with blanking plate N451850-2902.
**If only one track circuit is required, eliminate 1 track interface panel and its arrestors.
***These parts not shown in diagram

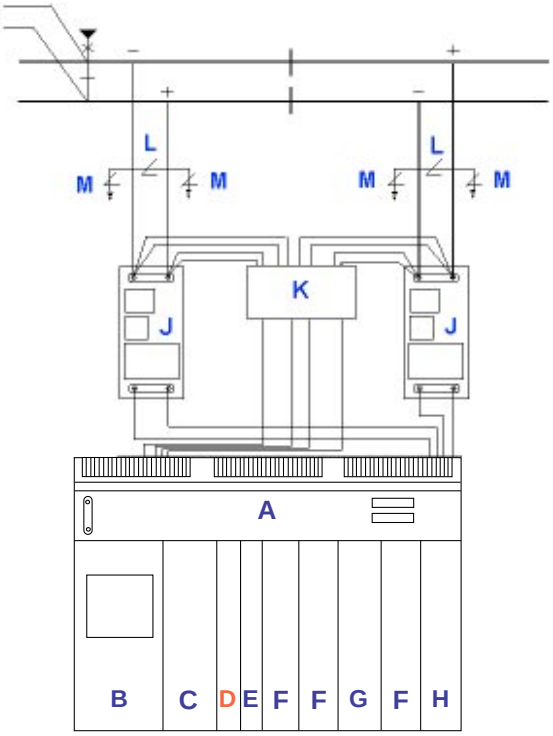
# Typical MICROTRAX Coded Track Circuit - Intermediate Signal Location Equipment List




| Letter | Part Description | Part Number | Quantity |
|---|---|---|---|
| A | Coded Track Cardfile | N451812-4101 | 1 |
| B | Blanking Plate (6.69”) | N451910-1101 | 1 |
| C | Power Supply | N166003-01 | 1 |
| D* | Color Light Lamp Driver | N451910-1501 | 1 |
| E | Blanking Plate (1.55”) | N451850-2901 | 2 |
| F** | Non-Isolated Module for 12-volt relay | N451910-6601 | 1* |
| G | Blanking Plate (.75”) | N451850-2902 | 1 |
| H | Track Interface Module | N451910-0701 | 1 |
| I | CPU Module | N451910-0103 | 1 |
| J*** | Track Interface Panel | N451835-0101 | 2 |
| K | Arrestor | N451552-0101 | 2 |
| L | Arrestor | N451552-0201 | 4 |
| M**** | Cardfile Brackets | X451812-4102 | 1 |
| N**** | PN-150 Relay | N322500-701 | 1 |

* Additional heads require additional lamp driver module. If searchlight signals are used, substi tute colorlight lamp driver with searchlight lamp driver (N451910-7301).
** Non-isolated module required if driving local 12-volt relays or receiving inputs. If not required, substitute with blanking plate N451850-2902.
*** If only one track circuit is required, eliminate 1 track interface panel and its arrestors.
**** These parts not shown in diagram.

# Typical MICROTRAX
# Coded Track Circuit- Electric Lock Equipment List




| Letter | Part Description | Part Number | Quantity |
|---|---|---|---|
| **A** | Coded Track Cardfile | N451812-4101 | 1 |
| **B** | Blanking Plate (6.69”) | N451910-1101 | 1 |
| **C** | Power Supply | N166003-01 | 1 |
| **D** | Non-Isolated I/O - 65 Ohm | N451910-6601 | 1 |
| **E** | Blanking Plate (0.75”) | N451850-2902 | 1 |
| **F** | Isolated I/O | N451910-2101 | 1 |
| **G** | Track Interface Module | N451910-0701 | 1 |
| **H** | Blanking Plate | N451850-2901 | 2 |
| **I** | CPU Module | N451910-0103 | 1 |
| **J** | Track Interface Panel | N451835-0101 | 2 |
| **K** | Quick Shunt Module | N451052-4601 | 1 |
| **L** | Arrestor | N451552-0101 | 2 |
| **M** | Arrestor | N451552-0201 | 4 |
| **N*** | Cardfile Brackets | X451812-4102 | 1 |
| **O*** | PN-150 Relay | N322500-701 | 1 |

*These parts not shown in diagram.

# MICROTRAX® Coded Track Circuit/End of Siding Controller

## Features

- Complete Small Interlocking / Coded Track capability in one low-cost package
- Applicable to CTC-Controlled locations
- Built-in, user-adapted Local Control Panel
- All Vital and Non-Vital Serial Links available
- Ample I/O: Non-Vital Data, Signal Heads, OS Track, Switch Correspondence

## Ordering Information

MICROTRAX Coded Track Circuit / End-of-Siding Controller systems are ordered from the complete family of MICROTRAX components.

## General

The US&S MICROTRAX Coded Track / End-of-Siding Controller offers the comprehensive solution to multi-purpose railroad wayside signaling control. With this unique package, a railroad can manage both coded track and simple interlocking functions from a single, low-cost unit. Based on US&S's highly successful MICROTRAX Coded Track Circuit System, this unit provides very long track circuits, high immunity to unwanted signals, simple site configuration set-up and all related features of the original MICROTRAX system (See pg. 2A(1). The new MICROTRAX unit adds total supervision of a simple end-of-siding location with vital functions such as switch correspondence and signal control, using remote or local panel operation. Compared to the expensive hardware requirements of present wayside signaling systems, the MICROTRAX Coded Track Circuit / End-of-Siding Controller provides the desired combination of economy and operational flexibility.

## Application Highlights

***Interlocking Control***

The MICROTRAX Coded Track / End-of-Siding Controller is suitable for simple interlocking applications such as switch machine control at the end of a passing siding and single crossover of double track. It is tailored for interlockings with self-restoring switches, but is capable of managing locations under CTC control (with siding track circuit). Standard functions such as switch control / correspondence, signal control and OS track occupancy are managed by proven vital logic adapted from US&S's MICROLOK system. A built-in local control panel (LCP) allows manual control and monitoring of the interlocking for equipment testing and contingency operations. For CTC-controlled interlockings, the new MICROTRAX system is equipped with a non-vital serial port for remote communications via a GENISYS code line. A vital master port allows tie in to a coded track type MICROTRAX system serving a siding track (See diagram on top of opposite side of this page). If required, extra coded track MICROTRAX units can be supervised by the new MICROTRAX controller in a daisy chained master/slave communications line. The same master port and a separate slave port are available for serial communications with a MICROLOK system or another MICROTRAX EOS controller. All other applications features of the original MICROTRAX system (e.g. signal lamp driving, quick shunt) are continued in the new EOS system, except provision for Isolated I/O.

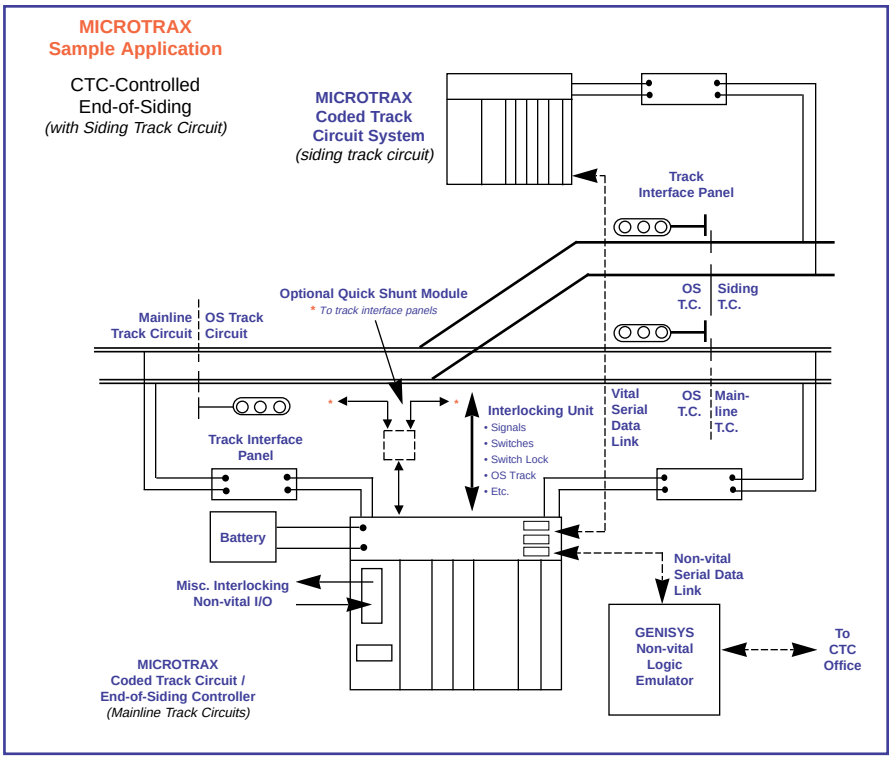
UNION SWITCH & SIGNAL

## Design Highlights

***Interlocking Control***

The MICROTRAX Coded Track Circuit / End-of-Siding Controller accommodates the same plug-in CPU and I/O modules (except Isolated I/O) as the MICROTRAX Coded Track Circuit system. A Serial Communications Controller Module is added to the EOS system to manage vital and non-vital links to external MICROTRAX, MICROLOK or GENISYS systems. Additional serial data ports are provided for these links. The power cut off relay is mounted externally to the EOS cardfile.

A unique feature of the MICROTRAX EOS is its built-in local control panel. The LCP consists of six LEDs and a generic, credit-card sized overlay (inserted into a front pocket) that allows the user to create any of four standard end-of-siding track displays. When the reversible card is inserted in the panel, two of the six LEDs are masked, leaving four LEDs for display of mainline and siding track occupancy indications. Spaces are provided on the card for signal nomenclature unique to the location. Toggle switches adjacent to the LCP display allow manual control of individual signals and the switch machine, enabling/disabling of the LED displays. Also, a key lock located on the panel limits access to authorized personnel. The Microtrax EOS unit features an additional 12-terminal connector for miscellaneous non-vital I/O, for example, train crew manual operation of the interlocking switch machine via a wayside push button.




## MTDS

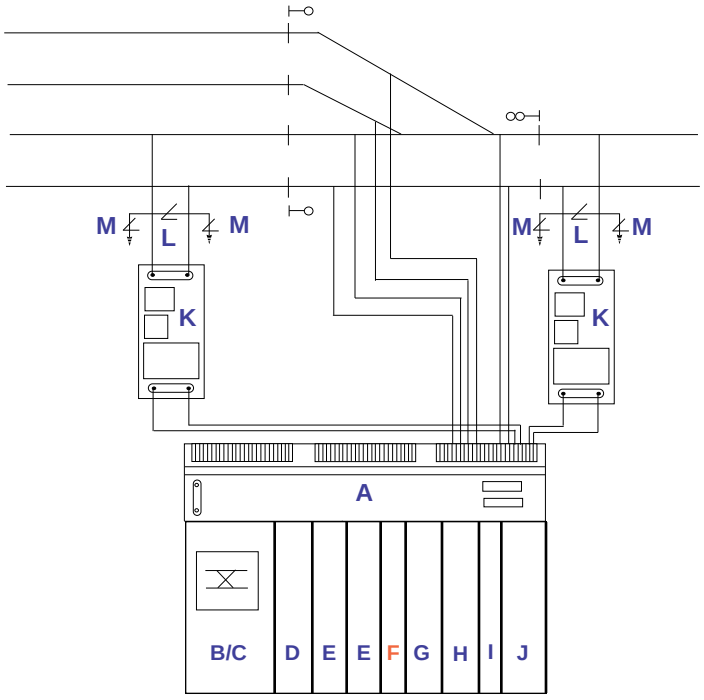
The serial link logic for the MICROTRAX EOS Controller is developed using the MICROLOK Development System (MDS). The MDS includes a logic "simulator" to test and debug the program prior to installation on the serial link module. Working in parallel with the MDS is the MICROTRAX Development System (MTDS). This software package allows programming of system level functions such as switch and signal control. The MTDS uses the same simple programming format as the MDS and also provides a "simulator" for exercising the compiled logic. No background in computer programming is required to use either development system.

## Specifications - Interlocking Control

**Note: Please refer to page 2A(3) for coded track, signal lamp, and local I/O specifications common to the original and new MICROTRAX EOS units.**

| | | | |
|---|---|---|---|
| ***OS Track Interface*** | 400 Hz transmitter<br>Series-tuned passive receiver<br>Series or parallel fouling<br>Parallel fouling: #15 turnouts or lower | ***Aux. Non-Vital I/O*** | 5 inputs<br>2 outputs |

# Typical MICROTRAX
# End-of-Siding Equipment List




| Letter | Part Description | Part Number | Quantity |
|---|---|---|---|
| **A** | Coded Track/ EOS Cardfile | N451812-1101 | 1 |
| **B*** | Local Control Panel | N451821-2001 | 1 |
| **C** | OS Track PCB | N451810-6701 | 1 |
| **D** | Power Supply | N166003-01 | 1 |
| **E**** | Color Light Lamp Driver | N451910-1501 | 2 |
| **F***** | Non-Isolated Module for 12-volt relay | N451910-6601 | 1* |
| **G** | Track Interface Module | N451910-0701 | 1 |
| **H** | CPU Module | N451910-0103 | 1 |
| **I** | Serial Link Module | N451910-5001 | 1 |
| **J** | Blanking Plate (1.55”) | N451850-2901 | 1 |
| **K**** | Track Interface Panel | N451835-0101 | 2 |
| **L** | Arrestor | N451552-0101 | 2 |
| **M** | Arrestor | N451552-0201 | 4 |
| **N***** | Cardfile Mounting Bracket | X451812-4102 | 1 |
| **O***** | PN-150 Relay | N322500-701 | 1 |
| **P***** | Cable Master - Port A | N50705101 | 1 |
| **Q***** | Cable EOS - Microtrax | N50705201 | 1 |

*Non-Vital I/O (N451810-4801) and OS Track Circuit PCB (N451810-6701) are located behind B.
**If searchlight signals are used, substitute colorlight lamp driver with searchlight lamp driver (N451910-7301).One more signal head may be controlled than shown in diagram.
***Non-isolated module required if driving local 12-volt relays or receiving inputs. If not required, substitute with blanking plate N451850-2902.
****If siding track is to be MICROTRAX, add MICROTRAX Coded Track Unit with Track Module and 1 track interface panel and associated arrestors.
*****These parts not shown in diagram.

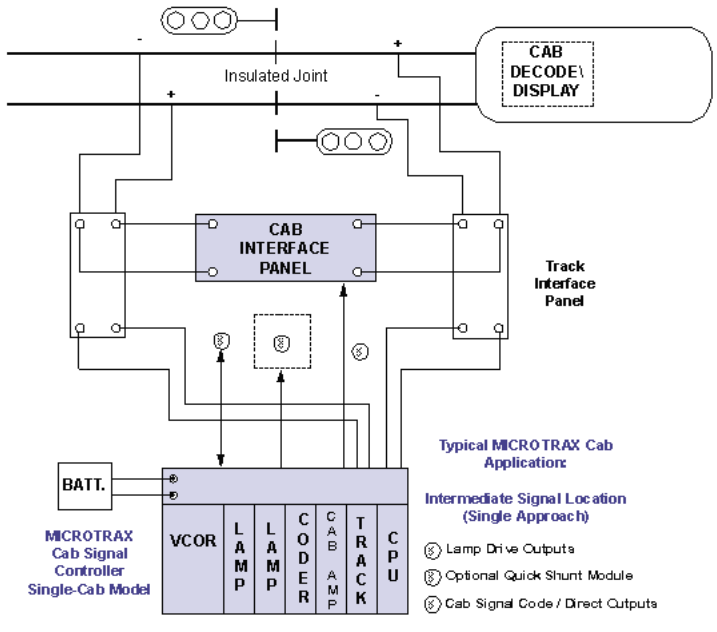
# MICROTRAX® Coded Track Circuit/Cab Signal Controller

## Features

- Combined coded track and cab signal overlay in one low cost package
- All standard cab codes and frequencies available
- Eliminates separate cab signal coding equipment
- Complete coded track capabilities including train detection, rail communications, signal lighting, local I/O, end or intermediate, and built-in diagnostics
- Cab signal output minimizes highway crossing circuit interface

## Ordering Information

Refer to Pages 2C(3-4) .




## Application

The MICROTRAX Coded Track Circuit / Cab Signal Controller manages standard DC coded track circuit functions such as train detection and track communications in parallel with the generation of cab signal codes. Cab signal current is overlaid on the track circuit signals, and is tuned for proper reception by locomotive receiver equipment. Two versions of the new unit are available: “Single Cab” and “Dual Cab”.

The Single-Cab version is typically connected at an intermediate location on both sides of a track circuit insulated joint (see diagram on this page.) “East” and “West” relays in the MICROTRAX Cab equipment connects the cab output to the appropriate side of the joints so that cab signals are applied to the exit

end of the track circuit consistent with train direction. The Dual-Cab MICROTRAX unit is typically used at end locations, producing separate coded cab signal currents for the two tracks of the interlocking.

A serial communications port on the Dual Cab MICROTRAX unit allows control by the MICROTRAX Coded Track Circuit/End-of-Siding Controller or a MICROLOK system (this port is also available on the single cab unit). The MICROTRAX EOS unit can also provide cardfile operating power for the MICROTRAX Cab unit, thus reducing hardware costs for the cab unit.

Both models of the MICROTRAX Cab unit produce standard codes of 50, 75, 120 and 180 CPM. Frequency options include 40, 50, 60 or 100 Hz. Additional code rates and frequencies can be incorporated in customized versions of the unit. No expensive auxiliary cab signal coding equipment (such as code generators or code-following relays) are required at the MICROTRAX Cab installation. Code selection, direction control, etc., are all managed by the MICROTRAX Cab application software.

## Design Features

***Cab Signal Modules***

Two types of plug-in modules are required to generate cab signals: Coder/Output and Cab Amplifier. To maximize available outputs for track circuit functions, the Coder/Output module includes two non-isolated outputs (in addition to 4 outputs on the non-isolated I/O Module). This module includes LEDs and a toggle switch that applies steady energy East or West for calibration of cab signal current. Cab signal frequencies are conveniently set by jumper on the Cab Amplifier Module.

The Dual Cab MICROTRAX unit incorporates two sets of cab coding modules, however cardfile space is available for a non-isolated I/O module. All cab signal and DC track circuit operations are managed by a single CPU module identical to that used in the original MICROTRAX system.

***Cab Interface Panel***

The MICROTRAX Cab Interface Panel includes numerous features designed to expedite cab signal calibration and minimize interference to highway crossing circuits. Different panel models are provided per carrier frequency. Rail current is easily set with four taps on the panel's power transformer. Although carrier frequency is set at the factory, jumpers in the panel's tuned filter permit custom tuning. These are useful for maximizing rail current in longer track circuits.

With a train at the exit end of the track circuit, excessive current drain of the battery is prevented by built in limiting. Harmonic generation, potentially a source of interference for highway crossing predictors and motion sensors is controlled in two ways. It is minimized by developing a stepwise sine wave approximation and the harmonic content is further reduced through a series of tuned circuits.

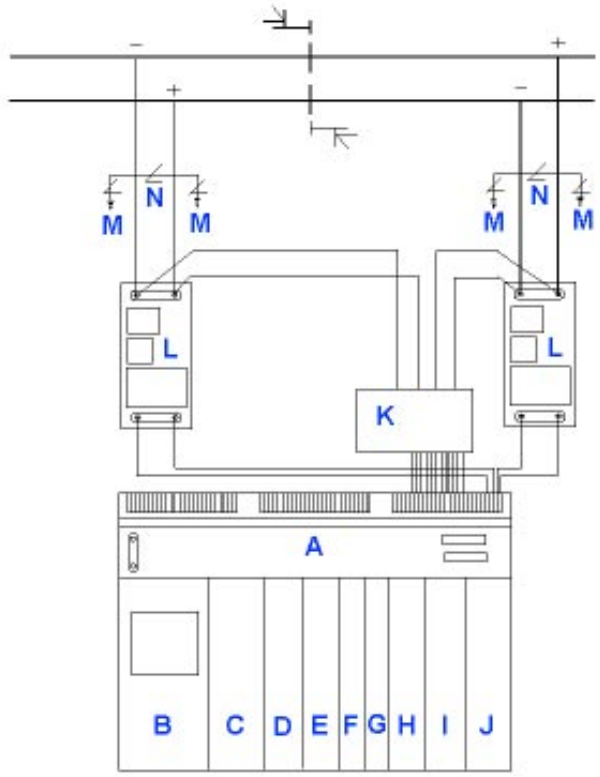
## Specifications

**Note: Please refer to page 2A(3) for coded track, signal lamp, and local I/O specifications common to the MICROTRAX EOS units.**

| | |
|---|---|
| ***Standard Code Rates*** | 50, 75, 120, 180 CPM |
| ***Standard Carriers*** | 40Hz, 50Hz, 60 Hz, 100 Hz |
| ***Battery Current*** | No outputs: 1.5A<br>60 Hz carrier / 50% on time: 10.0A* (max.)<br>100 Hz carrier / 50% on time: 15.0A* (max.) |
| ***Rail Current/Enter***<br>*(assumes 13V battery)* | 60 Hz: 1.0A @ 10K ft. @ 4 ohms / 1K ft. ballast<br>100 Hz: 2.0A @8K ft. @ 4 ohms / 1K ft. ballast |

* *for Single-Cab unit. Double current for Dual-Cab unit.*

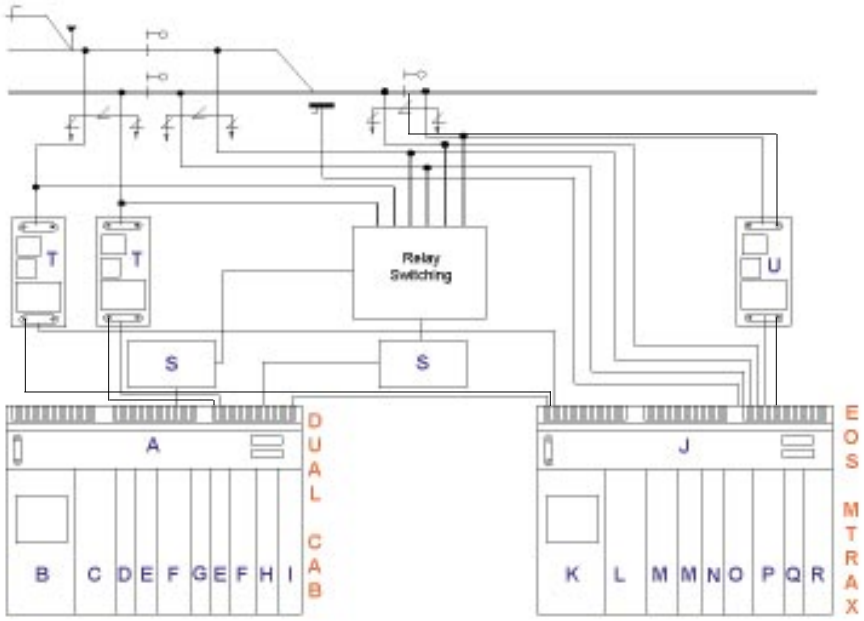
# Typical MICROTRAX
# (60Hz) Single Cab Signal Equipment List




| Letter | Part Description | Part Number | Quantity |
|---|---|---|---|
| **A** | Coded Track Cardfile | N451812-1501 | 1 |
| **B** | Blanking Plate | N451910-7201 | 1 |
| **C** | Power Supply | N166003-01 | 1 |
| **D** | Color Light Lamp Driver | N451910-1501 | 1 |
| **E** | Searchlight Lamp Driver | N451910-7301 | 1 |
| **F** | Coder Output Module | N451910-5801 | 1 |
| **G** | Blanking Plate (0.75") | N451850-2902 | 1 |
| **H** | Cab Amplifier Module | N451910-6401 | 1 |
| **I** | Track Interface Module | N451910-7603 | 1 |
| **J** | CPU Module | N451910-0103 | 1 |
| **K** | Cab Signal Interface Panel | N451835-0801 | 1 |
| **L** | Track Interface Panel | N451835-0104 | 2 |
| **M** | Arrestor | N451552-0201 | 4 |
| **N** | Arrestor | N451552-0101 | 2 |
| **O*** | Cardfile Brackets | X451812-410 | 1 |
| **P*** | PN-150 Relay | N322500-701 | 1 |

*These parts not shown in diagram.

# Typical MICROTRAX
# (40Hz) Dual Cab Signal Equipment List




| Ref. | Part Description | Part Number | Qty. |
|---|---|---|---|
| **A** | Coded Track Cardfile | N451812-1801 | 1 |
| **B** | Blanking Plate (6.69") | N451910-7201 | 1 |
| **C** | Power Supply | N166003-01 | 1 |
| **D** | Non-Isolated I/O (65 ohm) | N451910-6601 | 1 |
| **E** | Coder Output Module | N451910-5801 | 2 |
| **F** | Cab Amplifier Module | N451910-6901 | 2 |
| **G** | 50 CPM Coder Module | N451910-7001 | 1 |
| **H** | Track Interface Module | N451910-7601 | 1 |
| **I** | CPU Module | N451910-0103 | 1 |
| **J** | EOS Cardfile | N451812-1101 | 1 |
| **K** | Local Control Panel | N451821-2001 | 1 |
| **L** | Power Supply | N166003-01 | 1 |
| **M** | Color Light Lamp Driver | N451910-1501 | 2 |
| **N** | Non-Isolated I/O | N451910-6602 | 1 |
| **O** | Track Interface Module | N451910-0701 | 1 |
| **P** | CPU Module | N451910-0103 | 1 |

| Ref. | Part Description | Part Number | Qty. |
|---|---|---|---|
| **Q** | Serial Link Module | N451910-5001 | 1 |
| **R** | Blanking Plate | N451850-2901 | 1 |
| **S** | Cab Signal Interface Panel | N451835-1101 | 2 |
| **T** | Track Interface Panel | N451835-0104 | 2 |
| **U** | Track Interface Panel | N451835-0101 | 1 |
| **V*** | Arrestor | N451552-0201 | 6 |
| **W*** | Arrestor | N451552-0101 | 3 |
| **X*** | PN-150 Relay | N322500-701 | 1 |
| **Y*** | Termination Capacitor PCB | N451923-2501 | 2 |

*These parts not marked in diagram.

UNION SWITCH & SIGNAL



# MICROTRAX® Track Code Generator

## Features

- Simulates track circuit so application software can be verified before sending codes through rail
- Transmits and receives all track codes used by Microtrax
- Unit is lightweight and is equipped with a carrying handle
- Easy connections/quick setup

## Ordering Information

- US&S Part Number N16401801
- Contact US&S Sales for more info.

The Microtrax Track Code Generator is a lightweight, easily transported unit that simulates a track circuit. This is done so that the application software for a Microtrax unit can be tested and verified before actually sending codes through the rail. The Track Code Generator is designed to transmit and receive all of the track codes (A through W) used by the Microtrax system. This is accomplished by selecting a code using the generator's mode switch on the master or slave side of the unit and then entering it with an enter switch. Using the Track Code Generator, you can check that the proper aspects are selected, the proper relays have been picked and the proper track code is being transmitted by the unit under test. The unit's customized software is contained in 2 executive PROMS and 1 application PROM. The Microtrax Track Code Generator weighs 20 lbs. and comes equipped with a carrying handle and an easily removable face plate to protect the unit during shipment.

# MICROTRAX® Support - *Components*

## MICROTRAX-Based System Components: Coded Track Circuit/ End-of-Siding Controller/CAB Signal Controller

Components for all MICROTRAX-based systems are listed below and on the following page. Complete systems are developed from selected components. Make certain to check Configuration/Application Notes when ordering a plug-in module for a card file. Contact your US&S Sales Representative for unit pricing, pricing of complete systems or any special equipment configurations required.

| Order No. | Description | Configuration Application Notes |
|---|---|---|
| N451812-4101 | Coded Track Cardfile | No plug-in modules. Typical application: Non-cab intermediate, non-cab end-of-siding (siding track) |
| N451812-1101 | Coded Track/EOS Cardfile | No plug-in modules. Typical application: Non-cab end-of-siding (via interlocking control). |
| N451812-1501 | Coded Track/Single-Cab Cardfile | No plug-in modules. Typical application: intermediate locations with cab signal. |
| N451812-1801 | Coded Track/Dual-Cab Cardfile | No plug-in modules. Typical application: EOS locations with cab signal. |
| N166003-01 | System Power Supply PCB | All applications. |
| N451810-7501 | Secondary CPS | Coded track-only and coded track/cab applications, siding unit at interlocking . CPS only; system power. |
| N451910-0103 | CPU Module | Without application software EPROMs. All applications. |
| N451910-1501 | Color Light Driver Module | All applications. 2 signal heads, 2 isolated inputs. |
| N451910-7301 | Searchlight Lamp Driver Module | Requires Rev. 7 or higher CPU Executive software. Applications: Coded track with end-of-siding or coded track with cab-signal, 6-wire control. 2 signal heads, 2 isolated inputs |
| N451910-6602 | Non-isolated I/O Module | Drives 4 24V/150 ohm or greater relays. |
| N451910-1901 | Non-isolated I/O Module | This module has been replaced by N451910-6601. |
| N451910-6601 | Non-isolated I/O Module | All applications. Drives 4 12v/65 ohm non-isolated relays. 4 non-isolated inputs. |
| N451910-2101 | Isolated I/O Module | Coded track only. Drives 2 12V/65 ohm relays. |
| N451910-0701 | Track Interface Module | Typical applications and 100Hz cab |
| N451910-7601 | Track Interface Module | 40 Hz cab applications |
| N451910-7602 | Track Interface Module | 50 Hz cab applications |
| N451910-7603 | Track Interface Module | 60 Hz cab applications |
| N451910-2301 | Sleep Mode Module | Coded track applications only. |
| N451910-5001 | Serial Link Module | End-of-siding applications only. |
| N451821-2001 | Local Control Panel Module | End-of-siding applications only. |
| N451810-4801 | Non-Vital I/O PCB | Coded track/end-of-siding applications only. Placed behind Local Control Panel Module. |
| N451810-6701 | OS Track Circuit PCB | Coded track/end-of-siding applications only. Placed behind Local Control Panel Module. |
| N451910-5801 | Coder/Output Module | Coded track/cab applications only. |
| N451910-7001 | 50 CPM Coder Module | Coded track/cab applications only. |
| N451910-6401 | Cab Amplifier Module | Cab Signal cardfiles only (60/100Hz). |
| N451910-6901 | Cab Amplifier Module | 40 Hz/ 50 Hz |
| N451850-2901 | Blank Cardfile Panel 1.55" | All cardfiles. |
| N451850-2902 | Blank Cardfile Panel 0.75" | All cardfiles |
| N451910-1201 | Blank Cardfile Panel 6.69" | (N451812--1101) cardfile only. System Power Supply PCB. |

| Order No. | Description | Configuration / Application Notes |
|---|---|---|
| N451910-7201 | Blank Cardfile Panel | Blanking Panel (6.69") for N451812-1501 |
| N451910-1101 | Blank Cardfile Panel | Blanking Panel (6.69") for N451812-4101 |
| N451835-0101 | Coded Track Interface Panel | Non-cab intermediate and end-of-siding applications. 10 mH inductor |
| N451835-0102 | Coded Track Interface Panel | Non-cab intermediate and end-of-siding applications. 15 mH inductor for compatibility with 86 Hz crossing predictors. |
| N451835-0103 | Coded Track Interface Panel | Coded track/cab signal applications only. 20 mH inductor for compatibility with 100 Hz cab. |
| N451835-0104 | Coded Track Interface Panel | Coded track/cab applications only. 40 mH inductor for compatibility with 60 Hz and lower cab. |
| N451923-2501 | Termination Capacitor PCB | Mounts on Track Interface Panels -0101, -0102, -0103, -0104. Controls interference induced from high power lines. |
| N451835-0801 | Cab Signal Interface Panel | Coded track/cab signal applications only. For 60 Hz cab freq. |
| N451835-0802 | Cab Signal Interface Panel | Coded track/cab signal applications only. For 100 Hz cab freq. |
| N451835-1101 | Cab Signal Interface Panel | Coded track/ cab for 40 Hz. |
| N451052-4601 | Quick Shunt Module | All applications. |
| N322500-701 | Vital Cut-Off Relay | All applications with vital outputs. Mounted inside Coded track and Cab Signal cardfiles. External to EOS cardfile. |

# MICROTRAX® Support - *Development Systems*

## MICROTRAX Development System Components

Components for all MICROTRAX-development systems are listed below.. Make certain to check Configuration/Application Notes when ordering a development system. Contact your US&S Sales Representative for unit pricing, pricing of complete systems or any special equipment configurations required.

| Order No. | Description | Configuration / Application Notes |
|---|---|---|
| N451232-0119 | MICROTRAX Development System: 3-1/2" diskette | All applications (coded track circuit configuration). 1 diskette. |
| N451800-0301 | MICROTRAX Development System: 5-1/4" diskettes | All applications (coded track circuit configuration). 2 diskettes. |
| N451232-0105 | MICROLOK Development System: 5-1/4" diskettes | Coded track/EOS applications only (vital interlocking configuration). 1 diskette. |
| N451232-0113 | MICROLOK Development System: 3-1/2" diskettes | Coded track/EOS applications only (vital interlocking configuration). 1 diskette. |
| J703104-0004 | EPROM Programmer | Load system application software into EPROM. |
| N451458-7201 | Cable, EPROM Programmer to PC | -- |
| J715029-0562 | Blank Application Logic EPROM | -- |

# MICROTRAX® Support - *Cable Assemblies*

Contact your US&S Sales Representative for information on MICROTRAX cable assemblies not listed below.

| US&S Order No. | Description | Length | Connectors |
|---|---|---|---|
| N50704901 | Serial Microtrax-Genisys | 30 inches | 25-Pin Male “D” - 25-Pin Male “D” |
| N50705101 | Serial Microtrax-Microtrax | 8 inches | 25-Pin Male “D” - 25-Pin Male “D” |
| N50705201 | Serial Auxiliary Microtrax-Microtrax | 30 inches | 25-Pin Male “D” - 25-Pin Male “D” |
| N50705202 | Serial Auxiliary Microtrax | 10 feet | 25-Pin Male “D” - 25-Pin Male “D” |
| N50707901 | Serial Microtrax | 10 feet | 25-Pin Male “D” - 25-Pin Female “D” |
| N50708001 | Serial Auxiliary Microtrax-Microtrax | 3 feet | 25-Pin Male “D” - 25-Pin Male “D” |
| N50708901 | Microtrax A - Microtrax B | 38 inches | 25-Pin Male “D” - 25-Pin Male “D” |
| N50709001 | Microtrax A - Microlok J8 “D” | 14 feet | 25-Pin Male “D” - 37-Pin Male “D” |

UNION SWITCH & SIGNAL

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# MICROLOK® Vital Interlocking Control System

## General

The MICROLOK system is a microprocessor-based controller that performs the vital functions of a relay logic interlocking, but at considerable reduction in hardware and cost.

MICROLOK systems manage the full range of interlocking subsystems including signals, switch machines, track circuits, traffic and line wire circuits. The system is equally adaptable to large and small interlockings for application circuits such as switch, route, approach and time locking, signal and switch control and signal lighting. Larger application requirements are handled by connecting several MICROLOK units via a vital serial data system. MICROLOK systems can also communicate directly with the US&S GENISYS Series 2000 programmable controller, MICROLOK PLUS Vital + Non-Vital Control Package, and the new MICROTRAX Coded Track Circuit System.

MICROLOK plug-in circuit boards interface all vital inputs and outputs, and also form a modular central computer for the system. As a result, system maintenance can be expedited through board swapping. The MICROLOK vital logic constantly tests itself and cross-checks all inputs and outputs. Built-in error logging provides a thorough and easy access of system faults.

The MICROLOK software employs a comprehensive application logic compiler that a signal engineer can use to design and test the application logic on a personal computer; a background in computer programming is not required. The MICROLOK Development System provides all equipment and software needed to write, test and load the application program. For additional details on the design features and application possibilities of the MICROLOK system, contact your US&S Sales Representative.

*MICROLOK Rack*

### Ordering Information

- If planning a new system using MICROLOK equipment, consult US&S Sales before placing your order
- Baseline racks (partially equipped) and major rack units listed on next page
- Refer to the Microlok/Genisys Support section of this catalog for replacement, spare or expansion components for in-service Microlok systems

### Features

- Manages full range of interlocking subsystems and functions
- Vital microprocessor-based solid-state design
- Plug-in boards expedite field maintenance, upgrades
- User-friendly programming language Communications Protocols

### Service Manual Reference

- Refer to **SM 6400A, B, C.**

## Specifications

***Power Inputs*** 18 to 32Vdc (24Vdc nom.)

***Temp. Range*** -40°C to +70°C

***I/O PCBs*** Up to 15 relay drive, lamp drive and/or relay input PCBs per cardfile

***Relay Drivers*** 6 outputs per Standard, and Voltage-Limited PCBs. 3 outputs per Bipolar PCB

***Relay Input*** Standard Input PCB: 8 inputs, single-polarity, 4 inputs, bi-polar.
Input voltage options: 12 or 24 Vdc nom.

***Unit Weight*** 7.0 lbs.

***Serial Comm.*** Vital and non-vital: EIA RS423 (RS-232C compatible)

***Comm. Modes*** Vital: Full Duplex (standard)
Non-Vital: Half or Full Duplex

***Direct Interface*** 45ft. (cable length) max.
Current loop or modem required beyond.

***Master Slave*** 16 slave units, max.

***Relay Coils*** 1000 max. defined in application logic

***Lamp Drivers*** 4 outputs per PCB. 18, 25, and 36W options. 75W per PCB, max.

| US&S Order Number | Description |
|---|---|
| N451458-8601 | **Baseline Equipment Rack**<br>- CPU Cardfile w/ Processor, Peripheral, I/O Bus, Code Sys. Interface PCBs<br>- I/O Cardfile with no I/O PCBs<br>- One terminal strip<br>- CPU and Power Supplies<br>- PN-150HD (VCOR) Relay<br>- No intra-rack I/O cables |
| N451458-8701 | **Baseline Equipment Rack**<br>(Same as -8601 rack, but with 2 terminal strips) |
| N451458-8901 | **Baseline Equipment Rack**<br>(Same as -8601 rack, but with 2 terminal strips and no Code System PCB) |
| R451837-2404 | Rack Frame |
| N322505-701 | PN-150HD Relay (VCOR) |
| N451460-2301 | Power Supply Panel, I/O |
| N451460-2201 | Power Supply Panel, CPU |
| N451082-2901 | Cardfile, CPU |
| N451082-3801 | Cardfile, I/O |
| N451460-3001 | Serial Communications Adapter Panel |

Refer to the “MICROLOK/GENISYS Support - Printed Circuit Board” section of this catalog for information on ordering printed circuit boards for the MICROLOK system

# MICROLOK PLUS™ Vital + Non-Vital Control Package

## General

Union Switch & Signal offers a compact, low cost wayside control unit that combines code line, switch, signal and local control into one compact enclosure, making it especially cost-effective for single end-of-siding and small interlockings. The MICROLOK PLUS system employs the circuits and software of the MICROLOK vital interlocking system and GENISYS non-vital controller. These time-tested systems have successfully utilized the microprocessor in a wide range of large wayside control applications. The MICROLOK PLUS system builds on their success by integrating a complete, microprocessor-based vital and non-vital control capability in one 19" cardfile.

MICROLOK PLUS shares the effective, user friendly application logic of the MICROLOK and GENISYS controllers.

***MICROLOK PLUS VITAL + NON-VITAL CONTROL PACKAGE***

## Application Features

The MICROLOK PLUS system unifies the main features of MICROLOK and GENISYS controllers in an affordable, space-saving cardfile. The unit is ideal for managing smaller wayside installations (such as a single end-of-siding) that may only require a handful of local relay inputs and outputs. As a result, the unit eliminates equipment overkill such as separate racks and cardfiles for just a few logic and local circuit interfacing boards. Likewise, no extra hardware is needed to set up a non-vital link at the wayside location; the MICROLOK PLUS package also interfaces to a local control panel or office computer.

Like the MICROLOK vital controller, the MICROLOK PLUS system can manage the control elements of a railroad vital interlocking. Its vital control section can operate switch machine circuits at turnouts and crossovers. Searchlight, color light and position light signals are compatible with the system's lamp outputs. A special circuit is available for most restrictive signal aspect indication in case of a system shutdown. Burned-out or missing signal lamps can also be detected; both hot and cold filament checks are provided. Vital inputs accepted by the MICROLOK PLUS system include signal repeaters, switch machine position and track occupancy.

This system also offers all of the vital serial link capabilities of the MICROLOK vital controller. The MICROLOK PLUS system can operate as a Master or Slave unit when vital control responsibilities must be spread over several units. As many as sixteen MICROLOK and/or MICROLOK PLUS units can be controlled from a master unit. The MICROLOK PLUS unit can also be linked to the MICRO-TRAX Coded Track Circuit System.

### Features

- Interlocking management and office interface in one package
- Ideal for end-of-siding, other small-scale applications
- Uses proven Circuits of MICROLOK and GENISYS controllers

### Ordering Information

- Refer to the MICROLOK/ GENISYS Support Section of this catalog for replacement, spare or expansion components.

### Service Manual Reference

- Refer to **SM 6400B**

### Series 2000 Upgrades

See page 2I(4)

## Specifications

### General

| | |
|---|---|
| ***Power Input*** | 19.8 to 32.4 Vdc (24 Vdc nom.) |
| ***Power Output*** | +/-12 Vdc available for modem<br>270mA on +12 Vdc<br>135 mA on -12 Vdc |
| ***Temp. Range*** | -40°C to +70°C |
| ***Mounting*** | Equipment rack, wall or shelf |

### Vital Section

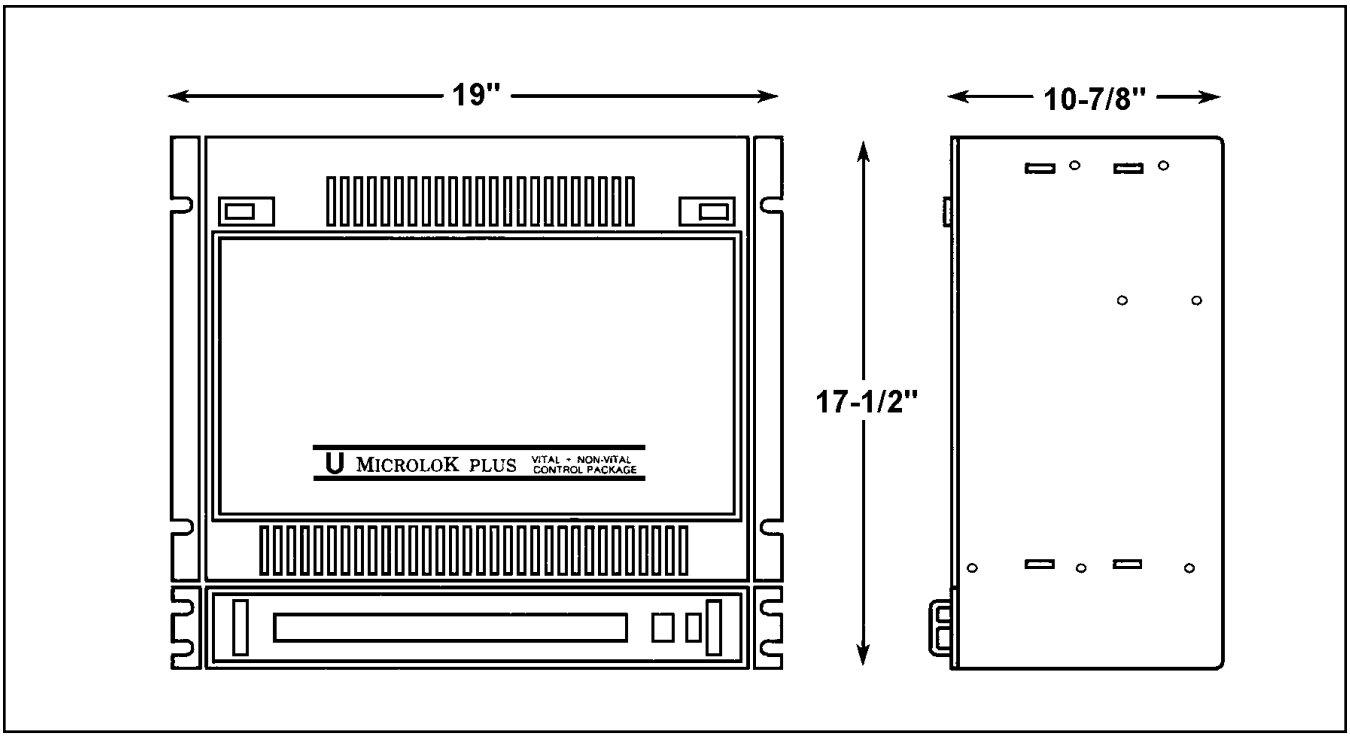
| | |
|---|---|
| ***Relay Drivers*** | - Up to 6 single-polarity outputs per Standard Relay Driver PCB<br>- Up to 3 bi-polar outputs per bipolar Relay Driver PCB |
| ***Lamp Drivers*** | - Up to 4 outputs per DC Lamp Driver PCB<br>- 18, 25, 36 W options<br>- 75 W of continuous heat dissipation-per PCB, max |
| ***Inputs*** | - Up to 8 inputs, single-polarity circuit per Standard Input PCB<br>- Up to 4 inputs, bi-polar circuits per Standard Input PCB<br>- 12 & 24 Vdc (nom.) input options |
| ***I/O Capacity*** | Up to 10 output (relay and lamp driver) and/or input PCBs in any combination |
| ***Serial Comm.*** | To vital and non-vital systems: EIA RS423 (RS-232C-comp.) |
| ***Comm. Modes*** | Vital: Full Duplex (Standard)<br>Non-Vital: Half or full duplex |
| ***Master/Slave*** | Max. 16 slaves controlled by Master |

### Non-Vital Section (GENISYS -Based)

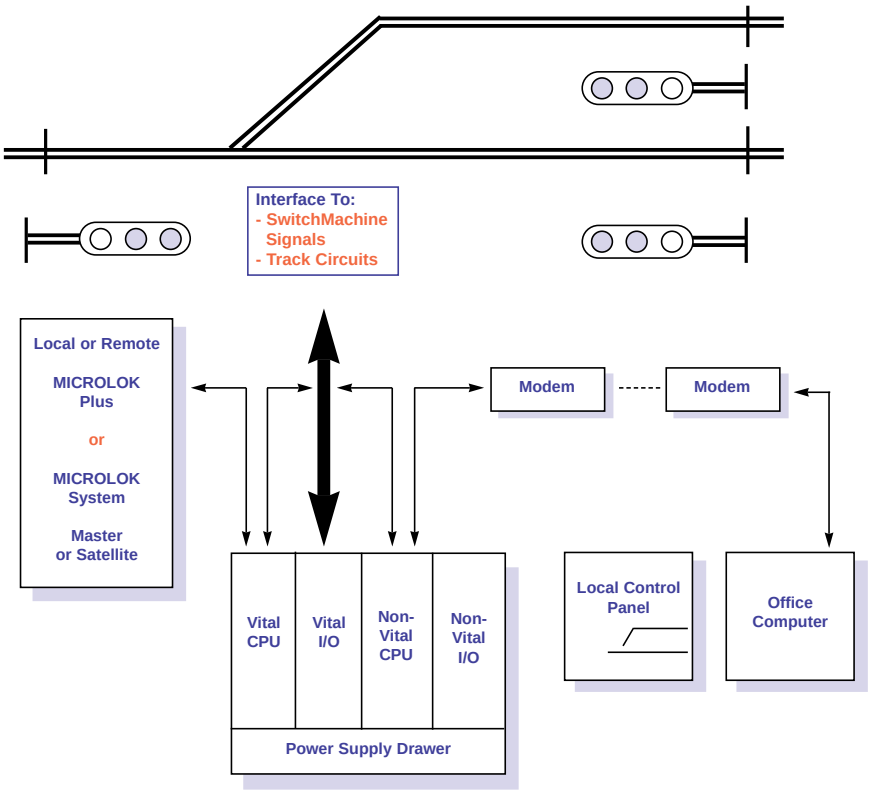
| | |
|---|---|
| ***Relay Drivers*** | 16 outputs per board, internal strobed or non-strobed, cleared or constant state at output off |
| ***Opto Inputs*** | - 16 inputs per board<br>- Input PCB types<br>5 to 32 Vdc (5Vdc assured min.)<br>8 to 32 Vdc |
| ***I/O Capacity*** | 1 or 2 relay-output and/or optical input PCBs |
| ***Serial Comm.*** | EIA RS423 (RS-232C-compatible) |
| ***Comm. Mode*** | Half or full duplex |
| ***Master/Slave*** | -255 Slaves controlled from Master (max.), 40 to 50 practical limit |

### Non-Vital Section (GENISYS Series 2000-Based)

| | |
|---|---|
| ***Relay Drivers*** | 32 solid-state “relay” outputs, internally strobed or non-strobed, cleared or constant state at output off (jumper-selected) |
| ***Opto Inputs*** | -32 Units<br>-Input PCB type: 8 to 32 Vdc |
| ***Serial Protocols*** | -ATCS-compliant MCP (Motorola or equivalent), over HDLC link<br>-Serial GENISYS, MCS-1, MCS-2<br>-DC code line: US&S 504B/C, 506A/C, 514 GRS K, K1, K2 |
| ***Comm. Mode*** | - ATCS mobile: RS-422, Serial: RS-423 (RS-232C/RS-422 com-patible) |
| ***Master/Slave*** | 64 Slaves (typical max.) |




*MICROLOK PLUS Cardfile Dimensions*




*MICROLOK PLUS End-of-Siding Location Example*

| US&S Order No. | Description |
|---|---|
| N451796-0102 | MICROLOK PLUS Cardfile, without PCBs, with P.S. Drawer and Power Cable |
| N451796-0101 | Cardfile w/o power supply, PCBs |
| N451796-0301 | Power Supply Drawer Assembly only |
| N451795-1401 | Power Cable (Drawer to Cardfile) |
| N322505-701 | PN-150HD relay (VCOR) |
| R451387-2404 | Standard 19 inch equipment rack |
| N451460-3001 | Serial Communications Adapter Panel |
| Refer to the “MICROLOK/GENISYS Support” section of this catalog for information on ordering printed circuit boards for the MICROLOK PLUS system | |

## GENISYS Series 2000 Upgrades

Our new GENISYS Series 2000 Enhanced Controller Board allows the MICROLOK PLUS system non-vital logic to directly communicate with ATCS-compliant radio networks, various types of serial code lines, and many US&S and GRS dc code lines. This board also permits complete programming and diagnostics with a laptop PC. Our new GENISYS Series 2000 32-bit non-vital input and output boards double the local I/O capacity of the MICROLOK PLUS non-vital section. See the MICROLOK/GENISYS Support section of this catalog for ordering information.

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# GENISYS & GENISYS Series 2000
## *Communications / Control Products*

### Features

- Serves many non-vital applications
- Stand-alone or multi-unit master/slave configurations
- Direct interfaces to ATCS radios, US&S and non-US&S serial code lines, many DC code lines
- Direct interfaces to MICROLOK and MICROTRAX systems
- PC-based field set-up and diagnostics (Genisys Series 2000)
- Powerful, easy to program logic

### Ordering Information

- If planning a new system using GENISYS equipment, consult US&S Sales before placing your order.

### Service Manual Reference

- For Genisys refer to **SM 6300A**, **SM 6300B**, and **SM 6300C**.
- For Genisys Series 2000 refer to **SM 6700A** and **SM 6700B**.

*GENISYS Cardfile*

### General

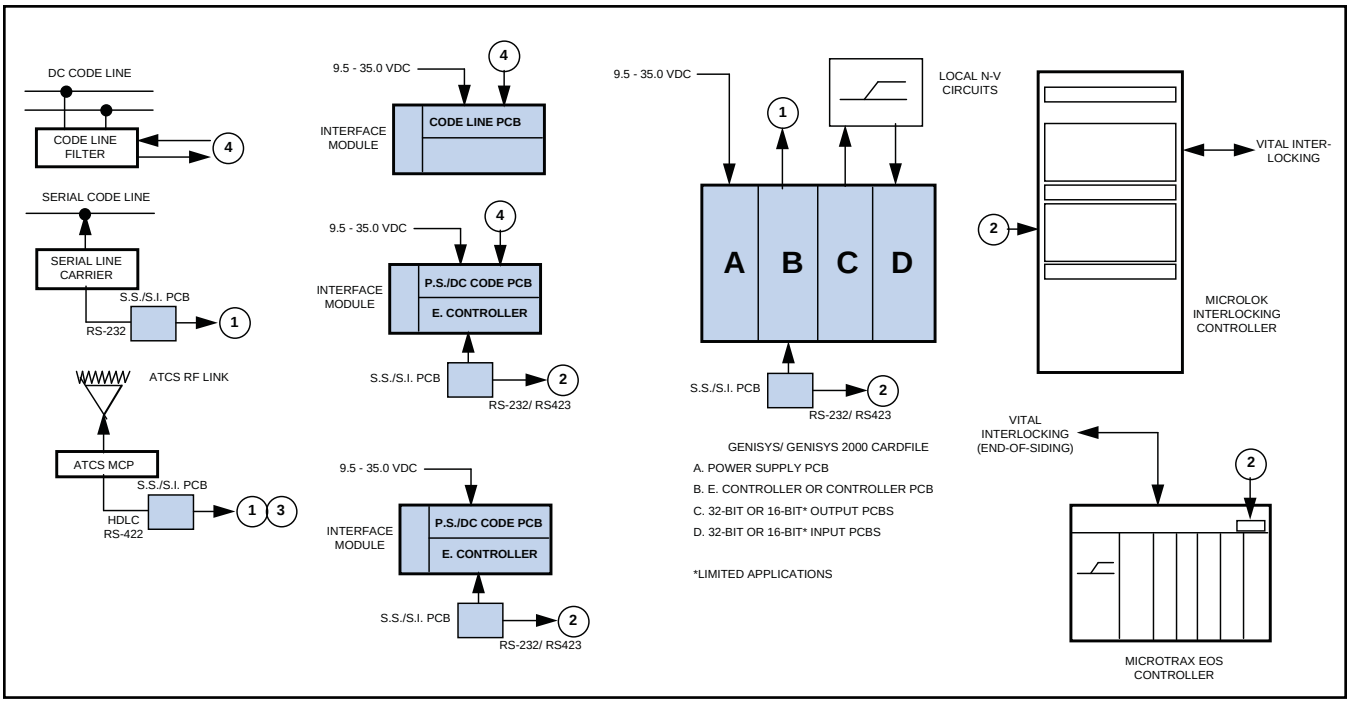
The US&S GENISYS Non-Vital Controller provides effective and efficient office field communications and local control at hundreds of railroad and mass transit installations around the world. It is well recognized in the rail transportation industry for its functional power, ease of installation set-up and minimal maintenance needs. In 1994, US&S further improved the GENISYS system with the introduction of its GENISYS Series 2000 family of components. These components expand the reach of GENISYS remote communications, and double the interfacing capacity of local control circuits.

### Applications

GENISYS and GENISYS Series 2000 products enable the complete development of non-vital remote communications/local control systems for railroad and transit applications. Applications include:

- Communication of CTC office commands (controls) to multiple field code units (serial communications)
- Communication of field code unit information (indications) to the CTC office (serial communications)
- Interface wayside local control panel (LCP) to vital interlocking controller (parallel communications)

GENISYS and GENISYS Series 2000 systems are typically used for code system application previously handled by relay logic or special purpose digital logic. These systems may also be specially programmed to combine standard code functions with customized application logic such as final stick circuits, LCP interface of field meet/pass logic. Standard GENISYS serial link protocol is employed by GENISYS / CTC communications. GENISYS Series 2000 CTC communications also include Harmon MCS-1 and MCS-2 serial protocols. GENISYS Series 2000 products also allow direct CTC communications over an ATCS-compliant radio network




***GENISYS Series 2000 Interface Module***

and traditional US&S/GRS DC code-lines. GENISYS and GENISYS Series 2000 systems can also be utilized at the CTC office in a controlling capacity for multiple field units. At the wayside location, the GENISYS and GENISYS Series 2000 systems can be directly linked with US&S's MICROLOK Vital Interlocking Control System [see pg. 2H(1)] and the MICROTRAX Coded Track Circuit/End-of-Siding Controller [see pg. 2B(1)]. Master/Slave system configurations can be developed in centralized or distributed modes to optimize use of processing logic and local I/O interfaces.

## Configurations and Features

The GENISYS and GENISYS Series 2000 product family includes various electronic and mechanical components that can be configured to meet the requirements of a wide range of system applications. Basic components include Controller boards for system supervision and serial communications interfacing, relay-output boards for energizing local N-V relay coils, optical-input boards for monitoring the local N-V relay contacts, interface boards for dc code lines, power supply converters and surge suppressor boards for serial links. PCB housings include cardfiles for locations with serial links and local N-V relay interface (or relay interface alone), and enclosures for locations that do not include local N-V interface (serial link interface alone). GENISYS Series 2000 components greatly expand upon the capabilities and applications of the original GENISYS components. In addition, they are designed for simple retrofit into existing GENISYS systems.

The GENISYS Series 2000 Enhanced Controller PCB features a more powerful 16-bit microprocessor and serial port for on-site or remote programming and diagnostics with a laptop PC. This board also incorporates new executive and application software compatible with a host of serial communications protocols ranging from ATCS-compliant mobile communications processor to traditional DC code lines. GENISYS Series 2000 32-bit output and input boards double the I/O capacity of previous boards, allowing much more local data to be interfaced per dollar. Refer to the charts in section 2K for the complete spectrum of GENISYS Series 2000 components.

## Application Software

GENISYS and GENISYS Series 2000 Controller application logic may be programmed by the customer using a powerful, highly flexible software development system. This system allows the user to design the logic in familiar relay logic terms; no background in computer programming is required.

The development system includes a software "simulator" for testing and debugging the logic, and equipment for downloading the completed logic to an EPROM chip. Different development systems are provided for GENISYS and GENISYS Series 2000 controller boards.

## Specifications

### System

***Remote Comm.***

GENISYS 2000: ATCS-compliant MCP over HDLC serial link

GENISYS 2000: DC code lines - US&S 504B/C, 506A/C, 514, GRS K, K1, K2

GENISYS2000: Serial code lines- GENISYS, Harmon MCS-1, MCS-2

GENISYS: GENISYS protocol only

***Master/ Slave***

64 Slave Unit (typical max.)

***Serial Comm. Modes***

GENISYS 2000:
*ATCS MCP*: RS-422, GENISYS, MCS-1, MCS-2, RS-232
*MICROLOK*: RS-232/RS-423
*MICROTRAX*: RS-232/RS-423 (No TTL)

***Environmental***

-40°C to +70°C, 95% humidity

### Controller

***Basic Types***

GENISYS 2000: Enhanced Cont.
GENISYS: Controller

***Microprocessor***

Enhanced Controller: 16-bit
Controller: 8-bit

***PC Interface***

IBM-compatible DOS, 9-pin

***Application Logic***

GENISYS 2000: 128K bytes (max.)
GENISYS: 40K bytes (max.)

GENISYS 2000: 4000 “relay coils” (max.)
GENISYS: 1450 “relay coils” (max.)

### Local I/O PCBS

***Relay Output***

GENISYS 2000: 32-bit relay-output PCB, jumper-selectable between constant-state and strobed

GENISYS: 16-bit relay-output PCBs, multiple PCB options

***Optical Input***

GENISYS 2000: 32-bit opto-input PCB, 8-32 Vdc

GENISYS: 16-bit opto-input PCBs, multiple PCB options

### Power Input (GENISYS & GENISYS 2000 Units)

***Voltage Range***

DC: 9.5V to 35.0V dc
AC: 105V to 125V ac (18-PCB cardfile installations only)

***DC Ripple***

5% (max.)

***AC Frequency***

50 to 440 Hz

### 19" Rack-Mounted Units

***18-PCB Cardfile***

Up to 16 output or input plug-in PCBs, 44 contact PCB edge connectors

***2-PCB Card Enclosure***

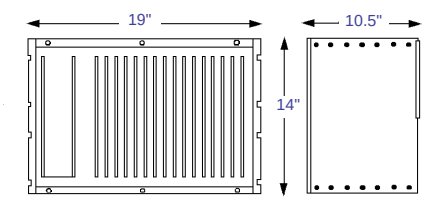
1 or 2 plug-in PCBs: Logic and/or power supply/code line interface

Serial 25-pin “D” connectors, dc code line wiring terminals

***Surge Suppressor/ Serial Interface Panel***

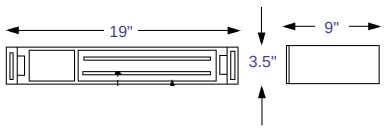
Up to 3 S.S./S.I. PCBs, stand-off mounted

**GENISYS / GENISYS Series 2000 18-PCB Cardfile**



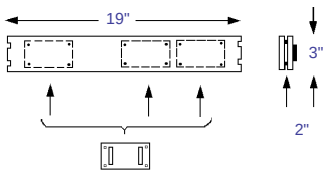

N085718-1909

**GENISYS Series 2000 2-PCB Card Enclosure**




N451891-0102

**GENISYS Series 2000 Surge Suppressor / Serial Interface Panel**




N451892-1401

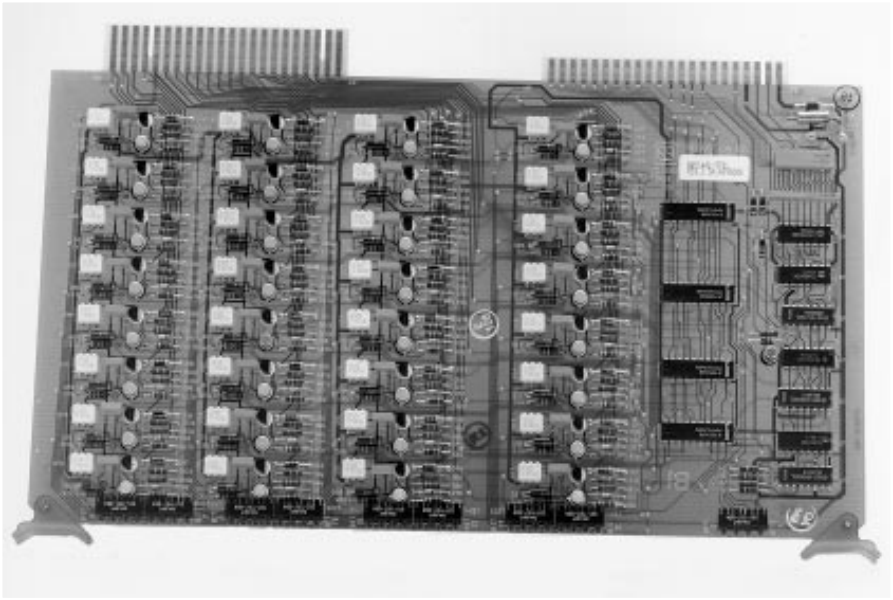
# MICROLOK® /GENISYS® SUPPORT
## *Plug-In Printed Circuit Boards*

### General

Plug-in printed circuits used in MICROLOK, MICROLOK PLUS, GENISYS, and GENISYS Series 2000 systems handle all major system control and interface functions, including:

- Primary control logic and program memory (microprocessor based)
- Event memory
- Serial interface to external devices
- Parallel output to relay coils and signal lamps
- Parallel input from relay and switch contacts
- Power input conversion

These boards are designed for reliable, long-term operation in a wayside railroad environment, as well as the central control office. Monitoring LEDs are mounted on the forward edge of each board to improve ease of viewing. Microprocessor control boards also contain critical set-up and programming switches on the forward edge. Principal control chips such as the microprocessor, PROMs and related peripherals are mounted with plug-in sockets, thus simplifying field service of the boards and program upgrades of the system.



***GENISYS Series 32-bit Non-Vital Output PCB***

### Ordering Information

- Standard plug-in boards listed in tabulation on next page
- Refer to respective service manuals for each system to confirm proper PCB order (part) numbers
- Make certain to note correct system application of board before ordering

### Features

- Major system control elements in plug-in form
- Speeds maintenance and upgrades

| US&S Order Number | System Applications | Name | Function / Specification |
|---|---|---|---|
| N451441-5302 | MICROLOK<br>MICROLOK-PLUS* | Code System Interface | Serial interface to GENISYS/ GENISYS Series 2000 unit or MICROLOK PLUS non-vital section |
| N451441-5502 | MICROLOK<br>MICROLOK-PLUS* | Peripheral | Application logic memory, interface to MICROLOK, MICROLOK PLUS (vital section), MICROTRAX slave section |
| N451441-5701 | MICROLOK<br>MICROLOK-PLUS* | Processor | Controlling logic. Vital cut-off output |
| N451441-6001 | MICROLOK<br>MICROLOK-PLUS* | I/O Bus Interface | Internal interface to local I/O boards. Serial interface to MICROLOK, MICROLOK PLUS (vital section), MICROTRAX Master Unit |
| N451441-8802 | MICROLOK<br>MICROLOK-PLUS* | Standard Input | Vital Input. Total inputs: 8. Input range: 9.6 to 20 Vdc (12Vdc nom.) |
| N451441-8803 | MICROLOK<br>MICROLOK-PLUS* | Standard Input | Vital Input. Total Inputs: 8. Input range: 13.5 to 33 Vdc (24 Vdc nom.) |
| N451441-8601 | MICROLOK<br>MICROLOK-PLUS* | Standard Relay Driver | Vital relay output. Single polarity external circuit. Total outputs: 6. Relay drive: 9.9 to 16.2 Vdc (nom.) |
| N451441-8501 | MICROLOK<br>MICROLOK-PLUS* | Volt.-Limited Relay Driver | Vital relay output. Single polarity external circuit. Same as N451441-6501, except no-load output voltage: 24 Vdc (vs. 40 Vdc for -6501) |
| N451441-8701 | MICROLOK<br>MICROLOK-PLUS* | Bi-polar Relay Driver | Vital relay output. Bi-polar external circuit. Total outputs: 3. Relay drive: 9.9 to 16.2 Vdc (nom.) |
| N451441-6702 | MICROLOK<br>MICROLOK-PLUS* | DC Lamp Driver PCB | Vital signal lamp output. 18W, 10V lamps. Total outputs: 4. Max. Total wattage per PCB: 75W. Lamp drive voltage: 9.9 to 16.2 Vdc. |
| N451441-6703 | MICROLOK<br>MICROLOK-PLUS* | DC Lamp Driver PCB | Vital signal lamp output. 25W, 10V lamps. Total outputs: 4. Max. total wattage per PCB: 75W. Lamp drive voltage: 9.9 to 16.2 Vdc. |
| N451441-7301 | MICROLOK<br>MICROLOK-PLUS* | DC Lamp Driver PCB | Vital signal lamp output. 36W, 10V lamps. Total outputs: 4. Max. total wattage per PCB: 75W. Lamp drive voltage: 9.9 to 16.2 Vdc. |
| N451441-9101 | GENISYS Series 2000<br>MICROLOK-PLUS** | Enhanced Controller | Controlling logic, application logic, memory, serial interface |
| N451441-5602 | GENISYS<br>MICROLOK PLUS** | Controller | Controlling logic, application logic, memory, serial interface |
| N451441-9801 | GENISYS Series 2000<br>MICROLOK PLUS** | Solid-State “Relay” Output | Solid-State “relay” output. Strobe or constant state at power-off. Total bits: 32. |
| N451441-4701 | GENISYS<br>MICROLOK PLUS** | Control & Delivery | Relay-output. Internal-strobe. Total bits: 16. Contacts: 100V, 0.5A, 10 VA (resistive load) |

* *Vital Section* ** *Non-Vital Section*

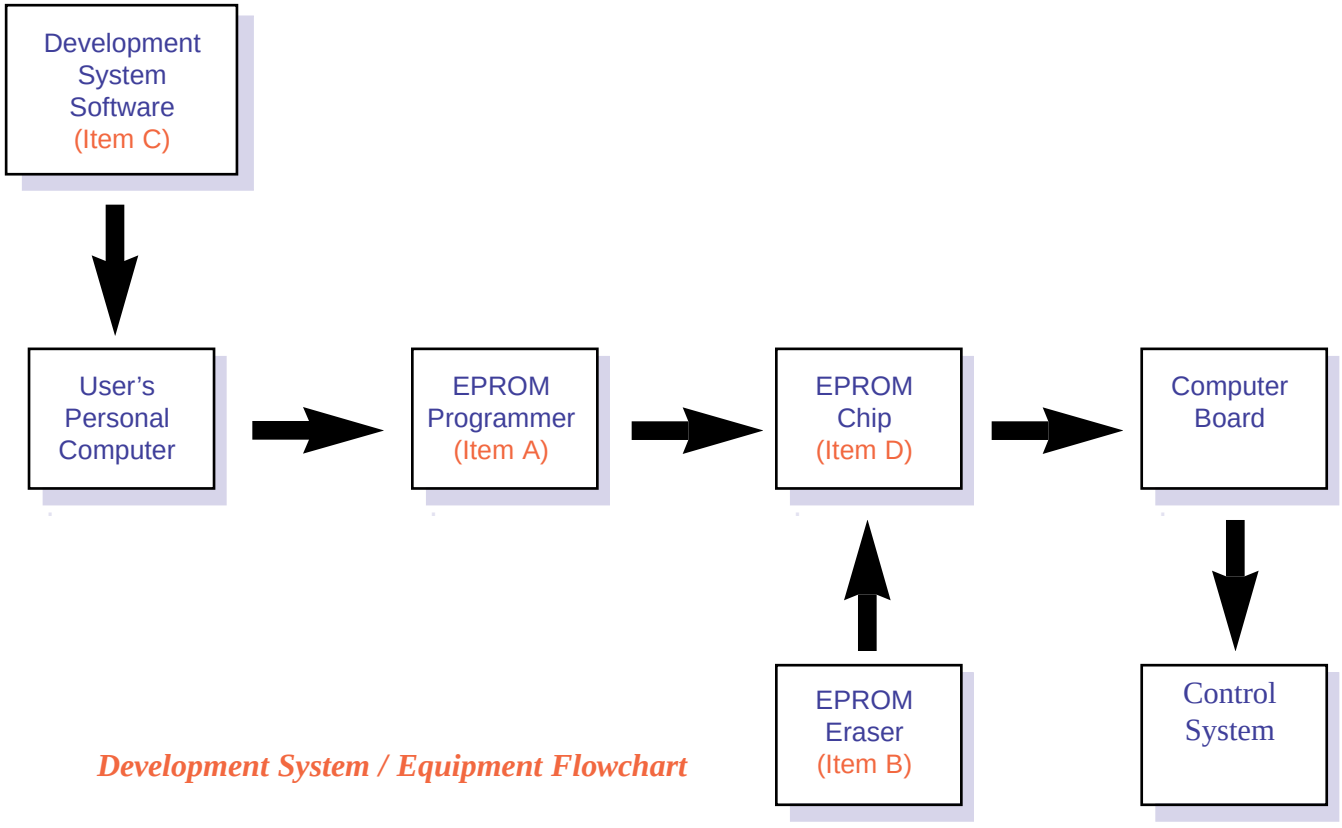
*Continued on next page*

| US&S Order Number | System Applications | Name | Function / Specification |
|---|---|---|---|
| N451441-7101 | GENISYS MICROLOK PLUS* * | Constant Delivery | Relay output. Constant state at power-off. Total bits: 16. Contacts: 500V, 2.0A, 100 VA (resistive load) |
| N451441-3601 | FCE-500 GENISYS MICROLOK PLUS** | Constant Delivery | Relay output. Non-strobed. Total bits: 16. Contacts: 500V, 2.0A, 100VA (resistive load). |
| N451441-9701 | GENISYS Series 2000 MICROLOK PLUS* * | Opto-Input | Optical input. Total bits: 32. Assured turn-on logic: 18 to 32 Vdc |
| N451441-5802 | GENISYS MICROLOK PLUS* * | Indication-Opto | Optical input. Wide range. Total bits: 16. Assured turn-on logic: 18 to 32 Vdc. 0.7 to 24 Vac RMS. Minimum turn-on/logic 10.5 Vac / Vac. Assured turn-off logic 0.25 Vdc/Vac |
| N451441-7202 | GENISYS MICROLOK PLUS* * | Indication-Opto | Optical input. High threshold. Total bits: 15. Assured turn-on/logic 18 to 32 Vdc, 5.7 to 24 Vac RMS. Minimum turn-on/logic 15.0 Vdc, 3.8 Vac RMS. Assured turn-off logic 4.5 Vdc, 3.4 Vac RMS. |
| N451441-7601 | GENISYS GENISYS Series 2000 | DC/DC Power Converter | 9.5 to 35 Vdc input. Ripple: 5% (max.). Power: 52W max. (approx.) |
| N451441-4601 | GENISYS GENISYS Series 2000 | AC/DC Power Converter | 105 to 125 Vac. 50 to 440Hz. 56W max. (approx.) |
| N451441-9401 | GENISYS Series 2000 | DC Code Line Interface | Interface to US&S 504B/C, 506A/C, 514, GRS K, K1, K2 dc code lines |
| N451441-9402 | GENISYS Series 2000 | DC Code Line Interface / Power Supply PCB | Interface to US&S 504B/C, 506A/C, 514, GRS K, K1, K2 dc code lines, +5, +/-12 outputs to Enhance Controller PCB |
| N451441-9403 | GENISYS Series 2000 | Power Supply PCB | +5, +/-12 outputs to Enhance Controller PCB |

* * *Non-Vital Section*

# MICROLOK® / GENISYS® Support

## *Development Systems, Executive/Application Program Chips*




*Development System / Equipment Flowchart*

### General

The MICROLOK, GENISYS and GENISYS Series 2000 Development Systems enable the customer to precisely tailor the system's application logic to their own system's configurations.

The MICROLOK PLUS Vital + Non-Vital Control Package also utilizes these development systems. Each system consists of an EPROM programmer for transferring the application program to the Controller PCB PROMs, an EPROM eraser and all required software. A cable is also provided for transferring the original program from the user's PC to the EPROM programmer.

The application logic is designed using a simple but highly efficient and flexible logic statement format. This allows the signal engineer to design the program in familiar relay logic terms. The development systems' simulators allow the engineer to fully test and debug the application program before it is loaded into the PCB EPROMs. The application EPROM program is loaded and retrieved using the EPROM programmer. This device also performs tests on the EPROM itself.

### Features

- Complete logic writing, debugging, simulation and testing
- Easy-to-use program language
- Designed for the signal engineer

### Ordering Information

- For more information on Development Systems, contact your US&S Sales Representative

## Development System Components

| US&S Order Number | Ref. | Description |
|---|---|---|
| J703105-0003 | A | EPROM Programmer |
| N451458-7201 | - | Cable, EPROM Programmer to PC (25-pin) |
| J703105-0005 | B | EPROM Eraser |
| N451232-0105 | C | MICROLOK Development System, 5-1/4” diskette, floppy/hard disk (combined) |
| N451232-0113 | C | MICROLOK Development System, 3-1/2” diskette, floppy/hard disk (combined) |
| N451232-0120 | C | GENISYS Series 2000 Development System, 5-1/4” diskette, floppy/hard disk (combined) |
| N451232-0121 | C | GENISYS Series 2000 Development System, 3-1/2” diskette, floppy/hard disk (combined) |
| N451232-0101 | C | GENISYS Development System, 5-1/4” diskette, floppy/hard disk (combined) |
| N451232-0112 | C | GENISYS Development System, 3-1/2” diskette, floppy/hard disk (combined) |
| J715029-0409 | D | Blank Application EPROM |

## GENISYS and GENISYS 2000 Pre-Programmed Chips

| US&S Order Number | Description |
|---|---|
| N451800-0201 | GENISYS 2000 Executive EPROM set: ATCS MCP |
| N451800-0202 | GENISYS 2000 Executive EPROM set*: GENISYS, US&S 500 series DC code |
| N451800-0203 | GENISYS 2000 Executive EPROM set*: GENISYS, GRS K series DC code |
| N451800-0204 | GENISYS 2000 Executive EPROM set: HARMON MCS |
| N451575-0903 | Test EPROM, GENISYS only |
| N451575-0910 | Code System EPROM, 6 controls, 10 indications**, GENISYS only |

* Both applications included in same EPROM set.
** US&S standard. Contact your sales representative for additional EPROMS in this series.

# MICROLOK® / GENISYS® Support

## *Data & Power Interface Connector / Cable Assemblies*

### General

US&S's MICROLOK, MICROLOK PLUS, GENISYS, and GENISYS Series 2000 systems are supported with a wide variety of data communications and power interface cables for various applications that these units may be used for. These cables enable rapid but orderly connection of the system to power and relay logic terminal strips and serial communications ports. Industry-standard PCB edge and / or "D" style plugs are fitted where needed for the application, or wires are left open for connection to individual terminal posts or field attachment of standard plugs. Many cables are equipped with an electrostatic shield which can be connected to an appropriate ground point to minimize line noise in data communication lines. US&S service manuals offer complete guidelines and wiring diagrams for the proper application of these cables.

### Features

- Vital and Non-Vital Applications
- Serial and Parallel Interfaces

### Ordering Information

- Standard cables listed in tabulations below and on next page
- Refer to respective service manuals for cable components

## MICROLOK and MICROLOK PLUS Serial Interface Cables

| US&S Order Number | Length | Type | Notes Ref. | Notes |
|---|---|---|---|---|
| N451458-8201 | 10 feet | EIA, vital (direct) | 1 | 1 MICROLOK or MICROLOK PLUS (vital sec.), Master port to Slave port. |
| N451458-8202 | 15 feet | EIA, vital (direct) | 1 | |
| N451458-8203 | 20 feet | EIA, vital (direct) | 1 | 2 MICROLOK only, dual CPU Master ports to dual CPU Slave ports. |
| N451458-8501 | 10 feet | EIA, vital (direct) | 2 | 3 MICROLOK single CPU or MICROLOK PLUS (vital sec.) Master port to modem. MICROLOK dual-CPU version not available. |
| N451458-8301 | 35 feet | EIA, vital (remote) | 3 | 4 MICROLOK single CPU or MICROLOK PLUS (vital sec.) Slave port to modem. MICROLOK dual-CPU version not available. |
| N451458-8001 | 35 feet | EIA, vital (remote) | 4 | |
| N451458-8401 | 5 feet | EIA, N-vital (direct) | 5 | 5 MICROLOK single CPU or MICROLOK PLUS (vital sec.) code system port to GENISYS or MICROLOK PLUS(non-vital sec.). MICROLOK dual-CPU version not available. |
| N451458-8402 | 10 feet | EIA, N-vital (direct) | 5 | |
| N451458-8404 | 20 feet | EIA, N-vital (direct) | 5 | 6 MICROLOK PLUS only, intra-unit connection: code system port (vital sec.) to Controller power (non-vital sec.) |
| N451458-9801 | 2.6 feet | EIA, N-vital (direct) | 6 | |

## GENISYS and MICROLOK PLUS Non-Vital I/O and Power Interface Cables

| US&S Order Number | | Description |
|---|---|---|
| N451458-3201 | 5 ft. | Cable Assembly for relay-output PCBs N451441-3601, N451441-7101. Use with relay circuits employing front, back and heel contacts |
| N451458-3202 | 10 ft. | |
| N451458-3203 | 15 ft. | |
| N451458-3204 | 20 ft. | |
| N451458-3205 | 25 ft. | |
| N451458-4101 | 5 ft. | Cable Assembly for relay-output PCB N451441-4701 |
| N451458-4102 | 10 ft. | |
| N451458-4103 | 15 ft. | |
| N451458-4104 | 20 ft. | |
| N451458-4105 | 25 ft. | |
| N451458-4107 | 35 ft. | |
| N451458-4201 | 5 ft. | Cable Assembly for relay-output PCB N451441-3601, N451441-7101. Use with relay circuits employing front and heel contacts only |
| N451458-4202 | 10 ft. | |
| N451458-4203 | 15 ft. | |
| N451458-4207 | 35 ft. | |
| N451458-3101 | 5 ft. | Cable Assembly for Optical-Input PCBs N451441-7202 and N451441-5802. |
| N451458-3102 | 10 ft. | |
| N451458-3103 | 15 ft. | |
| N451458-3104 | 20 ft. | |
| N451458-3105 | 25 ft. | |
| N451458-3107 | 35 ft. | |
| N451458-3301 | 5 ft. | Cable Assembly for Power Supply PCB N451441-7601 (GENISYS only). |
| N451458-3302 | 10 ft. | |
| N451458-3303 | 15 ft. | |
| N451458-3304 | 20 ft. | |
| N451458-3305 | 25 ft. | |
| N451458-3307 | 35 ft. | |
| N451458-3901 | 5 ft. | Cable Assembly for Power Supply PCB N451441-4601 (GENISYS only). |
| N451458-3902 | 10 ft. | |
| N451458-3904 | 20 ft. | |

## MICROLOK PLUS Vital I/O Cables*

| US&S Order Number | Description |
|---|---|
| N451458-6501 | Standard Input |
| N451458-6601 | DC Lamp Driver |
| N451458-6701 | Standard Output |
| N451458-6702 | Voltage-Limited Output |
| N451458-6801 | Bi-Polar Output |

* These cables can be ordered for MICROLOK intra-rack connections between the I/O cardfile and the terminal strip(s).

UNION SWITCH & SIGNAL

2N(1)
Rev. 5/97

# Programmable System Status Monitor (PSSM)

## Features

- Advanced failover control for normal/standby CTC computers
- Assured management of control responsibilities
- Highly adaptable hardware and software configurations
- Readily interfaced to various computer and switchover systems
- Informative, user-practical displays

## Ordering Information

- Order basic PSSM unit and relay output module from tabulation on next page
- Relay output module not included with basic unit; order separately
- For application possibilities of the PSSM, contact US&S Sales

## Service Manual Reference

- Refer to **SM 6473**

## General

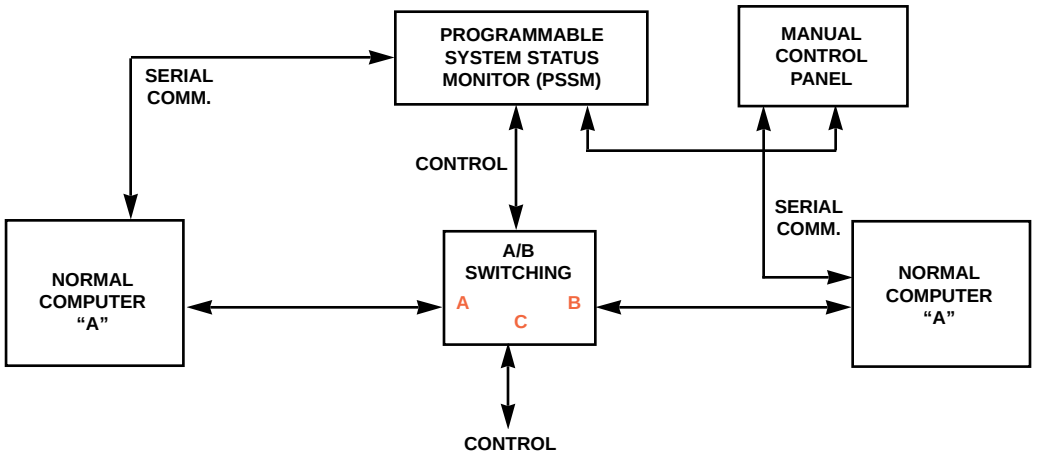
US&S's Programmable System Status Monitor (PSSM) offers a new level of sophistication in the management of normal and standby mainframe computers used in CTC centers. As such, it helps assure smooth and productive utilization of these computers. The PSSM monitors asynchronous serial transmissions from each computer and responds to both with the current system status (e.g. "A" ready, "B" failed). Failure of an on-line computer signals the PSSM to verify the readiness of the off-line computer and the transfer command to the switchover apparatus is given when verification is received.

The PSSM also constantly rechecks the state of the off-line computer while the on-line is operational, as well as basic communications and format continuity of messages. A failure condition is immediately declared when any of these ongoing tests is faulty. The PSSM is also capable of supporting manual control of the normal and standby computers in a contingency or longer term mode.

The microprocessor-based PSSM can be tailored to virtually any new or existing computer/switchover system with simple hardware and software modifications. Based on US&S's highly successful Programmable Remote Control to Computer Interface (PRCCI), the PSSM contains all required ports for serial and/or parallel digital communications with mainframes, switching devices and manual control panels.

Eight digital outputs are used for driving (optional) external status lights. These outputs are driven through plug-in relay output modules accessible inside the unit. Eight digital inputs to the PSSM provide various types of logic turn-on, turn-off and maximum input voltage levels for different system applications (refer to Specifications). Serial communications to the PSSM use EIA-standard RS-232C levels with baud rates selectable up to 9600BPS. Parity options are DIP-switch selectable.

Front panel displays on the PSSM include a 16-character alphanumeric LED display that reports the states of the normal and back-up computers. An array of discrete LEDs show the states of individual digital I/O and another indication of CPU A/B basic operational status, plus any transfer in progress. Models of the PSSM are available for facilities with standard 120V ac commercial power, or installations with 12 to 36V dc power.




## Specifications

***Unit Dimensions*** W= 19", D= 14", H= 5"

***Mounting*** Standard 19" equipment rack

***Internal Access*** Roll-out drawer with hinged top cover

***Connections*** 25-pin "D" (RS-232C serial)

24-way and 28-way discrete wire terminal blocks (digital)

5-pin male plug (power)

***Power Input*** Unit N451573-2101: 95-130V ac, 120V ac (nom.), 47-440 Hz, 0.75A (max.)

Unit N451573-2201: 12 to 36V dc, 7.5A (max.), 5% ripple (max.)

***Digital Outputs*** Total Available: 8
Four pulsed delivery, fixed @ 2 seconds duration.
Four constant delivery.

***Relay Output Module*** Form-C contacts, 500V (max.), 2A (max.), 100Va (max.) resistive load

***Digital Inputs*** Inputs 1-5:
Turn-on (logic 1): 7.0V dc +/- 1.5 V dc (min.)
Turn-off logic (logic 0): 4.0V dc, +/- 1.5V dc
Max. input: 32V dc

Inputs 6-8:
Turn-on (logic 1): 2.2V dc, +/- 0.2V dc (min.)
Turn-off (logic 0): 1.75V dc, +/- 0.2V dc
Max. input: 24V dc

***Serial I/O*** Asynchronous, EIA RS-232C compatible

***Bit Rates*** 150, 300, 1200, 2400, 4800, 9600

| US&S Order Numbers | Description |
|---|---|
| N451573-2101 | PSSM, 120V ac power input |
| N451573-2201 | PSSM, 12-36V dc power input |
| N451657-3701 | Relay output module for digital outputs |

# Programmable Remote Code to Computer Interface (PRCCI)

***Programmable Remote Code to Computer Interface (PRCCI)***

## General Information

US&S's Programmable Remote Code to Computer Interface (PRCCI) is a highly flexible system for exchanging controls and indications between a computerized control office and variety of field code systems, including relay-based, asynchronous code and high speed digital code. The PRCCI is capable of direct data communication to these systems over a dc code line or a carrier type communication line. Up to eight PRCCI units can be tied to a single computer port (asynchronous data) in an office installation. Field-installed units can be controlled from the office computer using a combination of leased-line and stand-by (dial-up) modems that help maintain constant communications in the event of trouble on the dedicated modem line. PRCCI application available as of January 2, 1992 include:

- US&S Relay Code: 501, 502, 502A, 504B, 504C, 506, 506A, 506C, 514, 514A1, 549 Flexicode, 550 Flexicode
- US&S High Speed Digital Code: DDL-601
- US&S Asynchronous Code: GENISYS®
- GRS Relay Code: Datatrain IV
- Harmon Asynchronous Code: MCS-1
- Safetran Asynchronous Code: SCS-128

## Design Features

The PRCCI is housed in a roll-out drawer assembly designed for installation in a standard 19" equipment rack. Internal circuit boards are hinged to allow access to set-up switches. Front panel indicators include a 16-character alpha-numeric LED display that generates control, indication and error messages in a clear text format. The state of each line/local input and output is indicated with 16 discrete LEDs, while eight additional function LEDs report the operating status of the unit itself.

Rear panel connectors include 25-pin "D" connectors for serial communications, 28 and 24-way straight terminal blocks for wiring of line/local outputs.

## Features

- State-of-the-art office/field data translation
- Compatible with wide range of electronic and relay systems
- Enhanced system maintenance and remote-communication options

## Ordering Information

- If planning for a new control system that will utilize PRCCI units, consult your Sales Representative before ordering any equipment. This will help ensure development of a system with the most cost-effective and efficient use of the PRCCI equipment.
- For basic units, key components and application program EPROMs, see tabulations on page 2O(5).
- Consult US&S Sales for additional system applications of PRCCI that may be implemented after publication of this catalog.

## Service Manual Reference

- Refer to **SM 6408**

The serial ports serve; office computer interface, remote diagnostics computer interface, serial code line interface, asynchronous code system (i.e. GENISYS) interface.

On the inside base of the unit are sockets for up to eight solid-state or relay output modules in any desired combination. These modules allow choice of EIA or TTL communications with a carrier, or a relay contact interface to a code line. (The relay output modules eliminate the need for the I/O interface rack of the original RCCI.)

## Specifications

***Unit Dimensions*** W= 19”, D= 14”, H= 5”

***Power Input*** Units N451572-0401, -0402: 95 to 130 Vac, 120 Vac (nom.)

Units N451572-0501, -0502: 12.0 to 36.0 Vdc, 7.5 A (max.), 5% ripple (max.)

***Temperature Range*** -40° C to +70° C

***Line/ Local Outputs*** Relay module: 200 Vdc (max.), 0.5 A (max.), 100 VA (max.) resistive load

Solid-state module, EIA level: +12, -12 Vdc
Inactive Output: More negative than -3 Vdc
Active Output: More positive than +3 Vdc

Solid-State Module, TTL level:
Inactive Output: 0 Vdc
Active Output: +5 Vdc

***Local Output Del:*** Delivery Pulse: 100 m sec.. (fixed)

***Line Local Inputs*** Standard*:
Turn-on time: 6 microsec(min.)
Turn-on voltage (logic 1):
7V+/- 1.5V (min.)
Turn-off voltage (logic 0):
4.0V+/- 1.5V
Maximum voltage: 32V

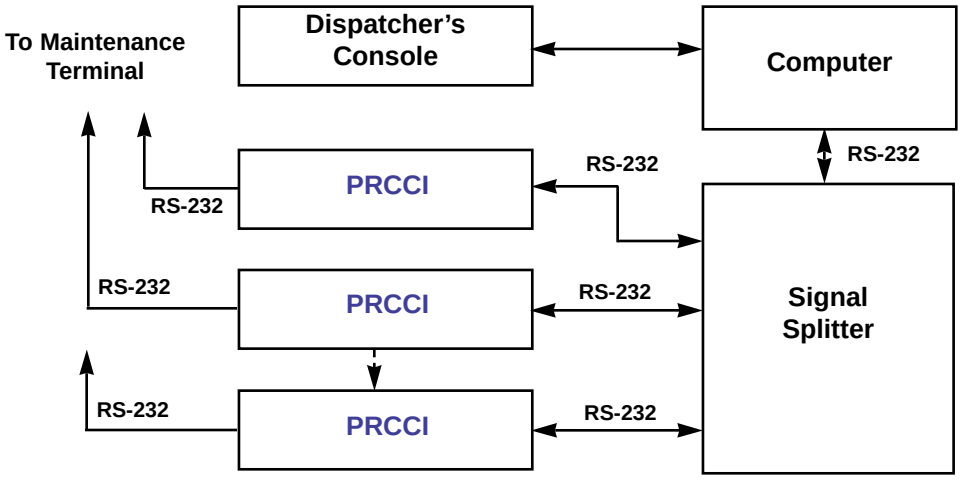
TTL:
Turn-on time: 6 microsec
Turn-on voltage (logic 1):
2.2V +/- 1.5V (min.)
Turn-off voltage (logic 0):
1.75V +/- 0.2V
Maximum Voltage: 24V

***Comm. Modes*** Serial Interfaces: EIA RS-232C, asynchronous Option: 20 mA current loop

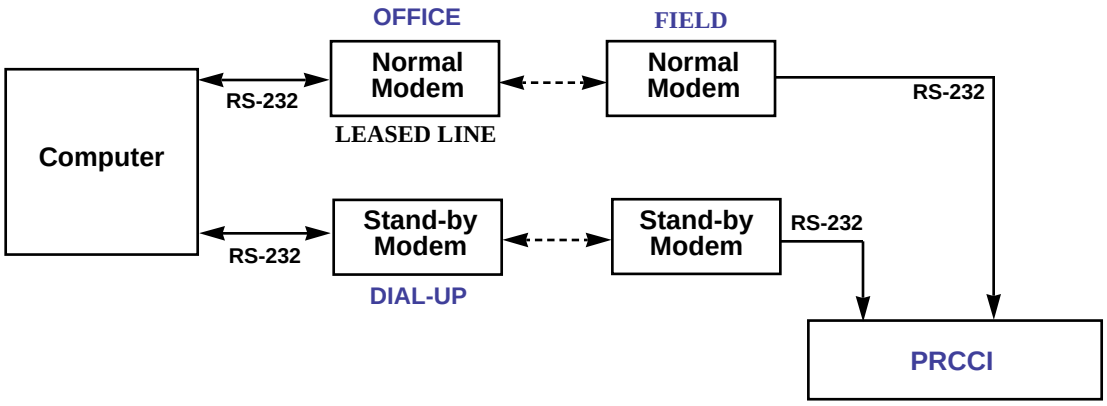
***Bit Rates*** 75, 150, 300, 600, 1200, 2400, 4800, 9600

* *Applies to units manufactured after June, 1989, with Interface PCB N451657-3901 (Rev.2) and N451657-3902 (all versions). Contact US&S for additional information*

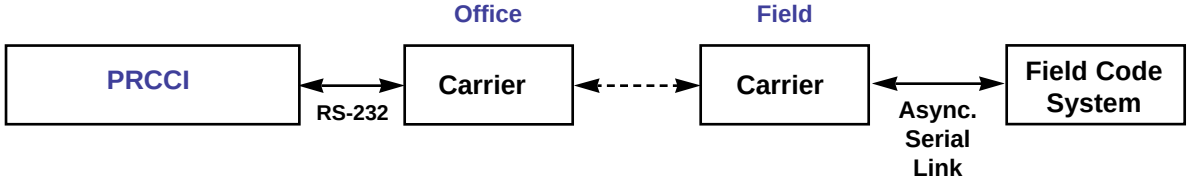
## Computer Interface (PRCCI at Office)



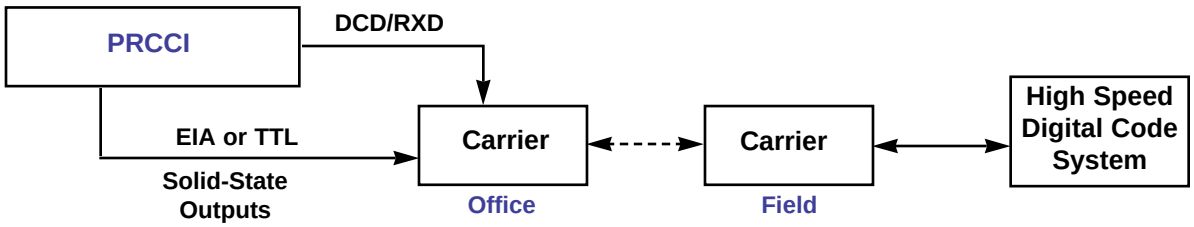

## Computer Interface (PRCCI in Field)



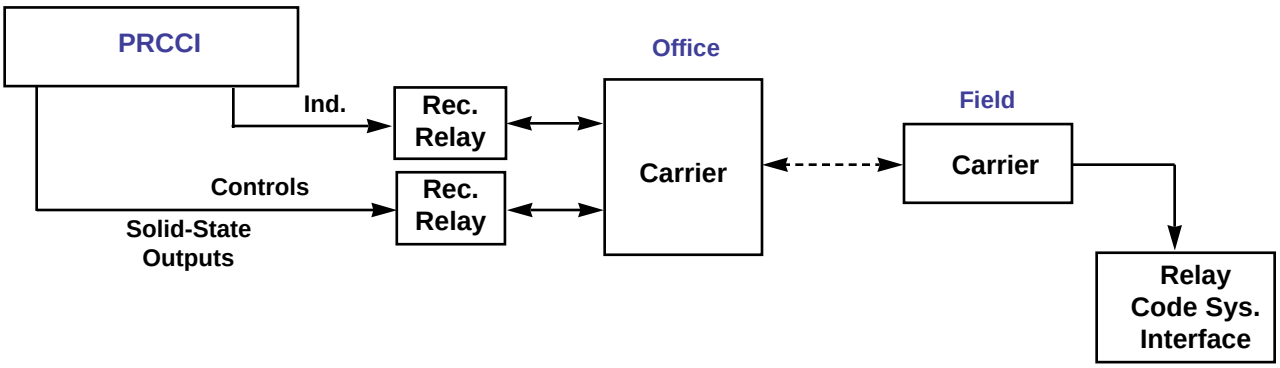

## Interface to ASYNCHRONOUS Serial Code Systems



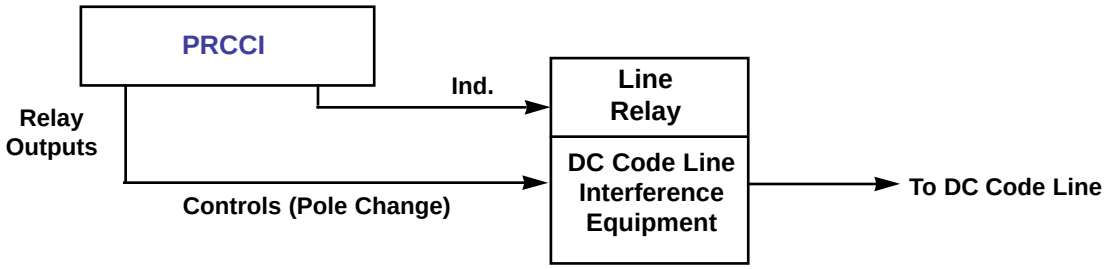
## Interface to High Speed Digital Code Systems




## Interface to High Speed Digital Code Systems - Carrier




## Interface to Relay Type Code Systems - DC Line



Order numbers for basic units and key components listed in tabulation below.
Recommended: Use these references to order spare or replacement equipment for in-service PRCCI systems.

## Basic Units

| US&S Order Number | Power Input | Std. Inputs* | TTL Inputs* |
|---|---|---|---|
| N451572-0401 | 120 Vac | 5 | 3 |
| N451572-0501 | 12 to 36 Vdc | 5 | 3 |

*Line / local ports

## Key Components

| US&S Order Number | Description |
|---|---|
| N451657-2701 | Basic CPU PCB, w/o EPROMs |
| N451657-3901 | Interface PCB |
| N451657-3902 | Interface PCB |
| N451657-3701 | Relay Output Module |
| N451657-3801 | Solid-State Output Module |

Order numbers for application program EPROMs listed below. Each number represents a set (two or three) of PROMs.

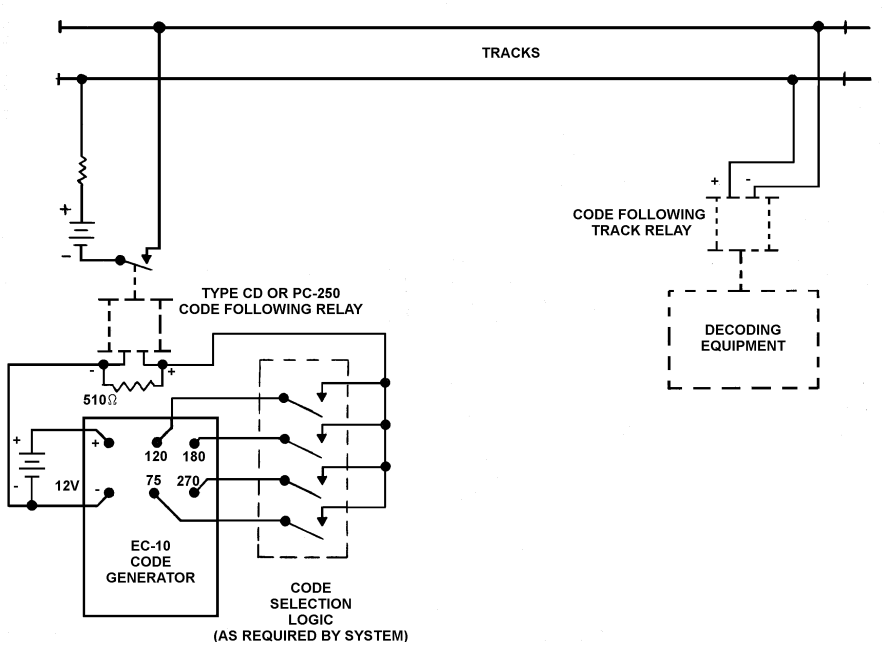
To order a complete EPROM set:
1. Order Office Communications PROM set N451800-0114 (first entry in tab.) for all applications.
2. Select desired system application from right-hand column.
3. Order PROM set for that application.

## EPROM Sets

| US&S Order Number | Description |
|---|---|
| N451800-0114 | Office Comm./ Maintenance (for CPU PCB “A” |
| N451800-0102 | US&S 5XX*, GRS K |
| N451800-0103 | US&S 550 |
| N451800-0105 | US&S GENISYS |
| N451800-0106 | GRS D1 |
| N451800-0107 | GRS E2 |
| N451800-0108 | GRS F |
| N451800-0109 | GRS J |
| N451800-0112 | HARMON MCS-1 |
| N451800-0113 | SAFETRAN SCS-128 |

*502, 502A, 504B, 504C, 506, 506C, 514, 514A1

# EC-10 Code Generator




*Typical EC-10 Code Generator Application Diagram*

## Features

- Electronically produced, highly stable code rates
- Replaces code transmitting relays
- Available with three, four or six code rates

## Ordering Information

- Standard EC-10 models listed on next page

## Service Manual Reference

- Refer to **SM 6059**

## General

US&S's EC-10 Code Generator provides code rates for cab signals and wayside signalling. The EC-10 may be applied in place of code transmitting relays in ac coded track circuits for cab signalling, or in dc coded track circuits for transmission of aspect information between blocks without line wire. Three versions of the EC-10 are available, supplying various combinations of standard code rates from 50 to 420 code per minute (CPM). This device is completely compatible with existing relay systems.

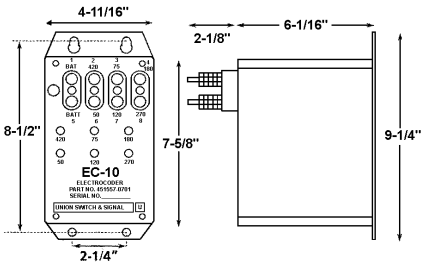
## Description

The EC-10 is a dc powered solid-state device contained in a compact sheet metal housing designed for shelf or wall mounting. AAR terminals (code rate labeled) on the front of the housing are provided for circuit wiring. An LED is provided for each available code rate; this LED flashes at the associated rate when the unit is operating. Part number N437501 contains an additional LED that indicates battery voltage applied (steady indication). The EC-10 is reverse polarity and short circuit protected, and meets all applicable AAR standards.

## Application and Operation

The EC-10 switches power to a code following relay at rates of 50, 75, 120, 180, 270 or 420 CPM. The rate is selected by external code selection logic. Lightning and surge transients are isolated from the EC-10 by the code following relay.

One or two code following relays in independent track circuits may be operated simultaneously by the EC-10. Upon supply of 12V dc battery power, all codes are continuously available. Highly stable code frequencies are provided, regardless of normal variations in input voltage and temperature.




*EC-10 Code Generator Dimensions*

UNION SWITCH & SIGNAL

## Specifications

| | |
|---|---|
| ***Input Power*** | 10.5V dc to 15.0V dc (12V dc nom.) |
| ***Input Current*** | 140 mA with 4 codes, single T.C. |
| ***Available Codes*** | See ordering tabulation below |
| ***Output Voltage*** | 1.0V below supply |
| ***Typical Application*** | Drives two 135-ohm 8/12V dc relays<br>US&S PC-250B plug-in or CD shelf relay<br>Relay requires 510 ohm snubbing resistor |
| ***Temp. Range*** | -40°C to +70°C |

| | |
|---|---|
| ***Output Current*** | 3-code EC-10 driving 1 relay-170 mA<br>3-code EC-10 driving 2 relays-200 mA<br>4-code EC-10 driving 1 relay-180mA<br>4-code EC-10 driving 2 relays-210mA<br>6-code EC-10 driving 1 relay-480mA<br>6-code EC-10 driving 2 relays-510mA |

| US&S Order Number | Description |
|---|---|
| N437501<br>N437602<br>N451557-0701 | 3-Code EC-10: 75, 120, 180 CPM<br>4-Code EC-10: 75, 120, 180, 270 CPM<br>6-Code EC-10: 50, 75, 120, 180, 270, 420 CPM |

UNION SWITCH & SIGNAL

2Q(1)
Rev. 5/97

# Solid State Ground Detector

***Solid State Ground Detector***

## Features

- Multiple ground detection indications and outputs
- Essential service for vital dc relay circuits
- Applicable to selected coded battery circuits
- Easily installed and connected
- Greater sensitivity than electromechanical detectors

## Service Manual Reference

- Refer to **SM 6239**

## Ordering Information

- Order individual units or complete kits from tabulation on next page

## General

The Solid State Ground Detector plays a key role in the operation of vital relay logic circuits, helping prevent ground fault leakage from reaching levels that could falsely energize a vital relay. Some types of coded battery circuits may also be monitored with this device.

The detector constantly measures leakage current and checks the measured value against an internally calibrated threshold value. When an excessive leakage current is detected, the detector sounds an audible alarm and lights front panel warning LEDs. In addition, the unit outputs an energizing voltage for a PN-150B relay (separate from unit) which, in turn, may be used to deliver a ground fault indication signal to a control or maintenance office. Potential sources of ground fault paths include deteriorated wiring insulation, excess moisture and dust and impact damage.

The Solid State Ground Detector is contained in a compact housing designed for attachment to an AAR standard relay frame. All electrical connections are made on a 12-contact male plug terminal block on the back of the unit. Kit versions of the detector are available with all mounting hardware included. User controls include a TEST toggle switch for checking the faults current threshold calibration, a disconnect switch to allow related circuit testing and a RESET button that restores the unit's vital output to the external relay. Indicators include three LEDs that give a variety of ground path reports (direct and interpreted) including:

1) Satisfactory circuit condition

2) Excessive ground fault current on the "+" side of the circuit

3) A coded ground fault condition

4) Loss of a ground rod

5) Loss of local power

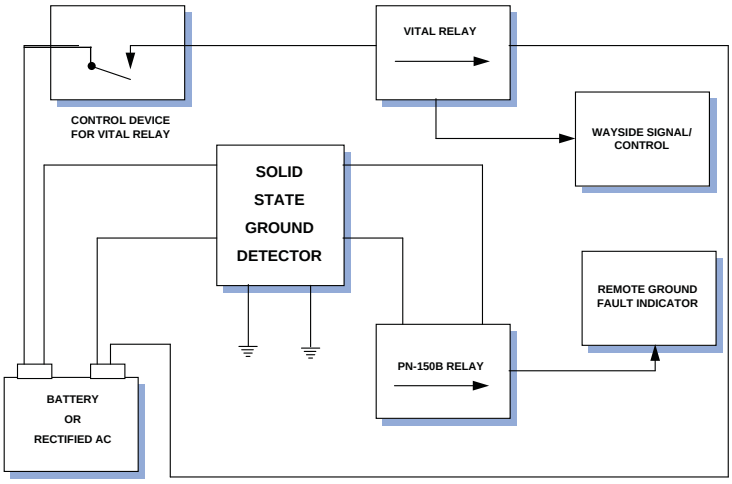
Models of the Solid State Ground Detector are available for electromechanical detectors in the 8 to 40V dc range, and provides greater detection sensitivity than earlier units.

UNION SWITCH & SIGNAL

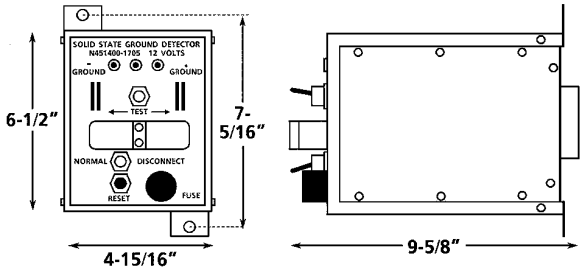
## Specifications

| | | | |
|---|---|---|---|
| ***Unit Weight*** | 5.58 lbs. | ***Operating Temp.*** | -30°C to +70°C (-22°F to +158°F) |
| ***Mounting*** | Bolt-on plug-in relay frame (AAR) | ***Input Voltages*** | See ordering tabulation |
| ***Connections*** | 12-contact discrete wire terminal block (male) | ***LED Flash Rate*** | 0.2 Hz |

| BASIC UNIT | KIT | DESCRIPTION | | |
|---|---|---|---|---|
| US&S Order Number | US&S Order Number | INPUT VOLTS (NOM.) | RANGE (VOLTS) | CPR PEAK VOLTS |
| N451400-1703 | X451400-1704 | 10 Rectified | - | 17.3 |
| N451400-1705 | X451400-1706 | 12 | 9.9 to 16.2 | 20.7 |
| N451400-1707 | X451400-1708 | 16 | 13.2 to 21.6 | 27.6 |
| N451400-1709 | X451400-1710 | 18 | 15.4 to 24.5 | 31.1 |
| N451400-1711 | X451400-1712 | 24 | 19.8 to 32.4 | 41.5 |




***Solid State Ground Detector Typical Application Diagram***




***Solid State Ground Detector Dimensions***

# ATT-20 Audio Track Transceiver

## General

The ATT-20 Audio Track Transceiver is a highly reliable AF track circuit device that operates in the audio frequency range of 12 to 20 Khz. This high AF range helps provide sharp block definition in applications such as highway crossings, island circuits, switch lock release and general train detection.

Unlike previous ATT series units, the ATT-20 can be used in both non-electrified and dc-electrified territories. It is also less susceptible to sources of EMI such as hand-held radios. In most applications, insulated joints are not required and track circuits up to 300 feet in length can be realized. The series mode version of the ATT-20 has reduced sensitivity to changes in ballast conditions compared to previous ATT models.

The ATT-20 is provided in two specific units: the series mode unit and the shunt mode unit. Neither can be used for the alternate application. On the shunt mode unit the front cover contains an access hole for adjusting the relay operating voltage level.

## Features

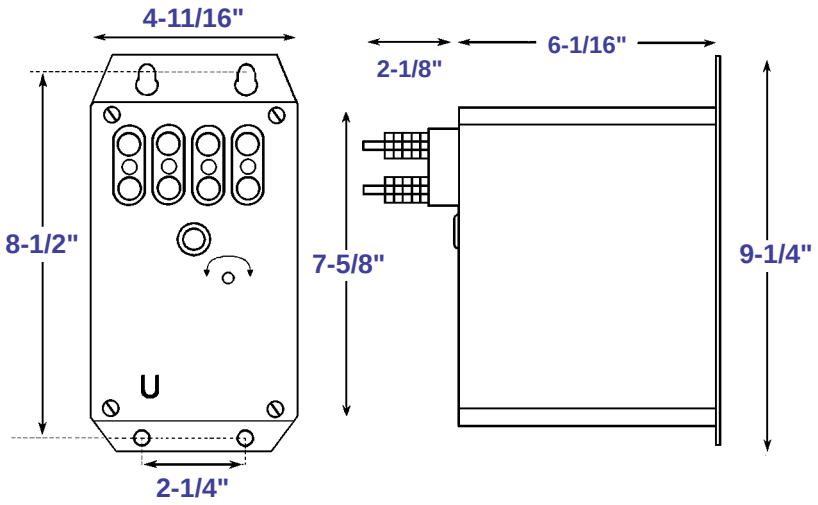
- Ideal for short range applications
- Electrified or non-electrified territories
- Low susceptibility to EMI and Ballast effects

## Service Manual Reference

- Refer to **SM 6299**

## Ordering Information

- Standard ATT-20 units listed in chart on this page.
- ATT-20 may be ordered as a direct replacement for the ATT-10. However, make certain to order either the shunt mode or series mode version of the ATT-20 to replace the corresponding application of the ATT-10. The series and shunt mode versions of the ATT-20 are not interchangeable in their application.
- See page 3M to order Surge Ripple Filter




| US&S Order Number | Description | |
|---|---|---|
| | Freq. (KHz) | Application |
| N451052-3901 | 12.8 | Shunt |
| N451052-3902 | 15.0 | Shunt |
| N451052-3903 | 20.0 | Shunt |
| N451052-3904 | 12.28 | Series |
| N451052-3905 | 15.0 | Series |
| N451052-3906 | 20.0 | Series |

## Specifications

***Power Inputs***

| | |
|---|---|
| Power Supply Voltage: | 9.8 - 15.2 Vdc |
| Ripple: | 1 V P-P (max.) |
| Load Current: | 600 mA |
| Fuse: | 0.75A fast-blow |
| Required Power Supply Filter: | US&S Surge Ripple Filter N451590-0301 |

***Transmitter***

| | |
|---|---|
| Shunt Mode Output/Voltage: | 1.0V RMS (modulated) into 5 ohm load |
| Series Mode Output Voltage: | 0.25V RMS (modulated) into 1 ohm load |
| Available Operating Frequencies: | 12.28 KHz, 15.0 KHz, 20 KHz |
| Carrier Frequency Tolerance: | ±0.5% |
| Modulation Frequency (all units): | 390 Hz ± 0.5% |
| Harmonic Output: | -30 db @ 2nd harmonic 2/12 ohm load in shunt mode |
| Output & Input Impedances: | 7 ohm - series mode<br>1 ohm - series mode |
| Output Voltage: | 7.65 Vdc into 400 ohms |

***Miscellaneous***

| | |
|---|---|
| Reverse Battery Protection: | Built in |
| Operating Temperature Range: | -40 C to +70 C |
| Maximum Block Length | 300 ft. shunt mode @ 300 ohms / 1K ft. ballast<br>150 ft. series mode @ 3 ohms / 1 K ft. ballast |
| Unit Weight: | 4 lbs. /14 oz. |

UNION SWITCH & SIGNAL

3B(1)
Rev. 5/97

# TRU-II Track Resonant and TRU-II Code Reset Units

## General

TRU-II is a 2-element track resonant unit for steady energy track circuit application in 25 Hz or 60 Hz ac propulsion territory. It is a direct replacement for existing centrifugal relays. The TRU-II Code Reset Unit adapts the TRU-II Track Circuit to single or double-direction code overlay track circuit applications. It resets the coded track signal to the desired steady energy condition.

***TRU-II Track Resonant Unit***

The TRU-II Track Circuit Unit is provided in three basic models:

1. 100 Hz-only unit
2. Combination 91.67/100 Hz unit set to 91.67 Hz
3. Combination 91.67/100 Hz unit set to 100 Hz

The second and third models are set at the factory to the indicated frequencies, but can be changed in the field to the alternate frequency. This is done by changing taps, allowing easy track circuit conversion when changing from 25 to 60 Hz propulsion systems. A reversible label on the unit shows either selected frequency. In operation, the TRU-II Track Circuit Unit energizes its track (output) relay so long as the track circuit is unoccupied and operating properly. Track occupancy or a system failure causes a TRU-II to release the track relay. Other features of the TRU-II include:

- Track circuit length, shunting constraints and broken down insulated joint protection comparable to phase selective and centrifugal relay systems
- Minimal field retrofit work required to replace centrifugal relay
- Lower power consumption than centrifugal relays
- Excellent noise rejection capability
- No active electronics, no moving parts
- No periodic maintenance required
- Rack or shelf-mount; plug couplers for easy replacement

***TRU-II Code Reset unit***

In a code overlay application, the TRU-II Code Reset Unit is connected in parallel to the TRU-II Track Circuit outpad and assists the energizing of the track relay during the code reset period. The degree of assist is proportional to the steady state TRU-II output during the reset. Features of this unit include:

- No track circuit voltage boost required during code reset period
- Guards against false relay pick-up
- Operates on 25 Hz or 60 Hz propulsion systems
- Durable design - no transistors or electrolytic capacitors
- No periodic maintenance required
- Rack or shelf-mount; plug couplers for easy replacement

***Dual-Frequency Code Reset Unit***

The Dual-Frequency Module provides reset capability for additional standard code rates of 270 and 420 CPM, and operates at a second carrier frequency of 250 Hz. As such, it is ideal for today's higher speed rail traffic. This single package is a direct functional and mechanical replacement for all three versions of the present reset module. For additional information on the Dual-Frequency TRU-II Code Reset Module, request US&S Service Manual 6237A.

***Mini-Rack Assembly***

In a typical installation with cab code overlay, the TRU-II Track Circuit Unit and Code Reset Module are mounted in a "Mini-Rack", which is designed for shelf mounting (see above photo). These racks are useful for accomplishing wire for wire replacement of a shelf-mounted centrifugal relay. Each rack also contains a PN-150BH relay for the TRU-II Track Circuit Unit output and a PN-150B or PN-250B relay,

***TRU-II Code Reset Unit***

which serves as a repeater. The TRU-II Code Reset module is not required when code overlay is not in effect.

Mini-racks are available from US&S with various standard combinations of the TRU-II Track Circuit Unit, Code Reset Module and track relays (refer to ordering information). Plug-in relay bases with installed receptacle spring contacts are mounted on the mini-rack.

### Features

- TRU-II: Direct replacement for centrifugal relays
  TRU-II: 25 or 60 Hz propulsion, DC Territory
  TRU-II: High level lightning and surge protection
- Code Reset: Single or double-direction code overlay
  Code Reset: Guards against false relay pick-up

### Service Manual Reference

- Refer to **SM 6236** and **SM 6237**

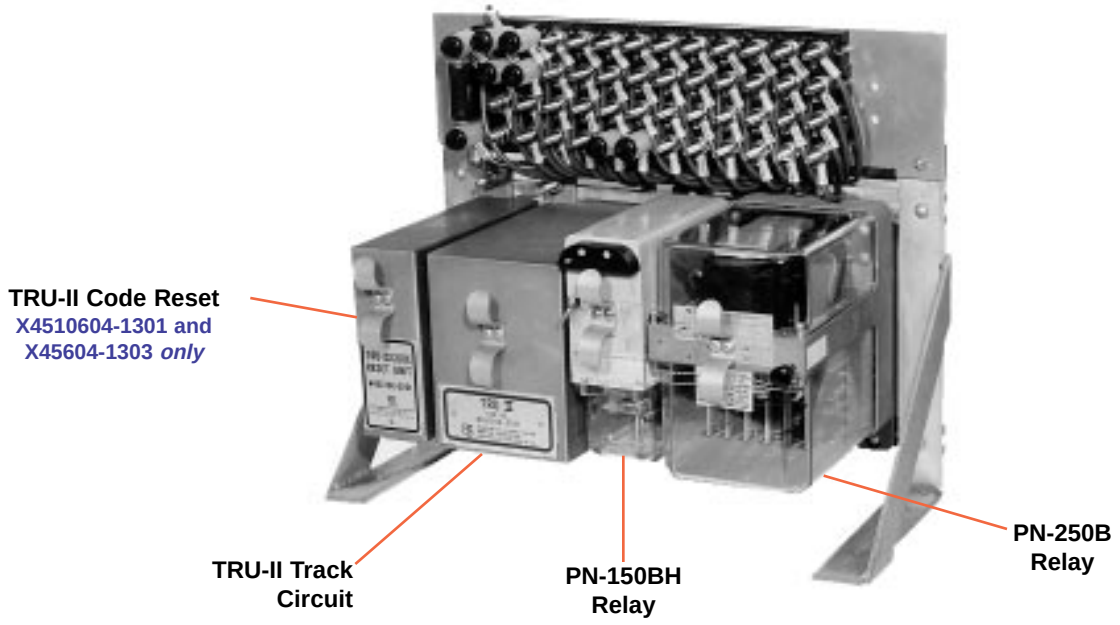
| Basic TRU-II Units | | | | |
|---|---|---|---|---|
| | Description | | | |
| US&S Order No. | Type | Avail. Freq. (Hz) | Freq. (Hz) set to | Mtg. Hdw. |
| N451206-0101 | Track Ckt. | 100 | 100 | - |
| N451206-0102 | Track Ckt. | 100 | 100 | X |
| N451206-0103 | Track Ckt. | 91.67 & 100 | 91.67 | - |
| N451206-0104 | Track Ckt. | 91.67 & 100 | 91.67 | X |
| N451206-0105 | Track Ckt. | 91.67 & 100 | 100 | - |
| N451206-0106 | Track Ckt. | 91.67 & 100 | 100 | X |
| N451206-0201 | Code Reset | 100 | 100 | - |
| N451206-0203 | Code Reset | 91.67 & 100 | 91.67 | - |
| N451206-0205 | Code Reset | 91.67 & 100 | 100 | - |
| N451206-0206 | Code Reset | 91.67 & 100 | 100 | X |
| N451206-0301 | Dual Freq. Code Reset | See specifications on next page for available frequencies | | - |
| N451206-0302 | Dual Freq. Code Reset | | | X |

## Ordering Information

- TRU-II track resonant and code reset units listed in following tables
- Complete TRU-II mini-rack assemblies (with operating units) listed below
- Refer to page 8F(2) to order PN-150BH relay (TRU-II track relay).
- Refer to page 8D(1) order PN-150B relay (TRU-II repeater relay).
- Refer to page 8D(2) to order PN-250B relay (TRU-II repeater relay).

| Complete Rack Assemblies | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Description | | | | | | |
| | TRU-II Ckt. | | | TRU-II Code R. | | Repeater Relay** | |
| US&S Order No. | Ref. | No. N451206- | Freq. (Hz) | No. N451206- | Freq. (Hz) | Type | Order No. *** |
| X451604-1001 | A | -0101 | 100 | -- | -- | PN-250B | N322554-802 |
| X451604-1301 | B | -0101 | 100 | -0201 | 100 | PN-150B | N322500-802 |
| X451604-1303 | B | -0103 | 91.67* | -0203 | 91.67* | PN-150B | N322500-802 |

* Refer to “TRU-II Basic Units” tabulation on page 8B(2) for combination-frequency units.
** All racks equipped with PN-150BH track relays. Refer to page 8F(2) to reorder this relay.
*** For reference only. Refer to pages 8D(1) and 8D(2) to reorder these relays.



## Specifications

***TRU-II***

| | |
|---|---|
| Local Voltage: | 110 or 120 Vac, ± 10% |
| Local Current: | 50 mA range |
| Track Voltage: | 10 Vac range |
| Track Current: | 100 mA range |
| Dielectric Breakdown Voltage: | 3000V, 60 Hz for 1 minute |
| Operating Temperature Range: | -40º to +70 Cº |
| Traction Power Environment: | DC to 60 Hz AC |
| Harmonic Immunity: | 91.67 Hz unit immune to 100 Hz (4th harmonic of 25 Hz traction power) |

***Standard Code Reset Unit***

| | |
|---|---|
| Local Voltage: | 110 or 120 Vac, ± 10% |
| Local Current: | 50 mA range - with required external 1K noise |
| Dielectric Breakdown Voltage: | 3000 V, 60 Hz for 1 minute on terminals 1 and 2 to chassis only |
| Operating Temperature Range: | -40º ± 70ºC |
| Traction Power Environment: | DC to 60 Hz AC |
| Harmonic Immunity: | 91.67 Hz unit immune to 100 Hz (4th harmonic of 25 Hz traction power) |
| Code Rate: | 180 code, maximum |
| Coder On/Coder Off Time: | 38%, minimum |

***Dual Frequency Code Reset Unit***

| | |
|---|---|
| Local Voltage: | 110 or 120 V ac + 10% @ 50, 60, 91.67 or 100 Hz |
| Local Current: | 20 mA |
| Dielectric Breakdown Voltage: | 3000 V, 60 Hz for 1 minute on terminals 1 and 2 to chassis only |
| Operating Temperature Range: | -40ºC to +70ºC |
| Traction Power Environment: | DC to 60 Hz AC |
| Frequency Immunity: | Reset will not energize:<br>25 Hz, propulsion, 150V ac<br>60 Hz, propulsion, 150V ac<br>250Hz, signal, 125V ac |
| Code Rate: | 420 code, maximum |
| Coder On/Coder Off Time: | 38%, minimum |

# Phase Selective Unit

## General

US&S's 91.67 - 100 Hz Phase Selective Unit (PSU) is a highly reliable device for driving code following relays in power frequency track circuits.

It eliminates the need for line wires and/or signal cables, and directly replaces the larger, more expensive centrifugal vane relays used in this application. The PSU is also more immune to traction current than centrifugal relays. It may be employed in 25 or 60 Hz propulsion territories and set to 91.67 or 100 Hz carrier frequency by simply changing connections on the unit's wiring terminals.

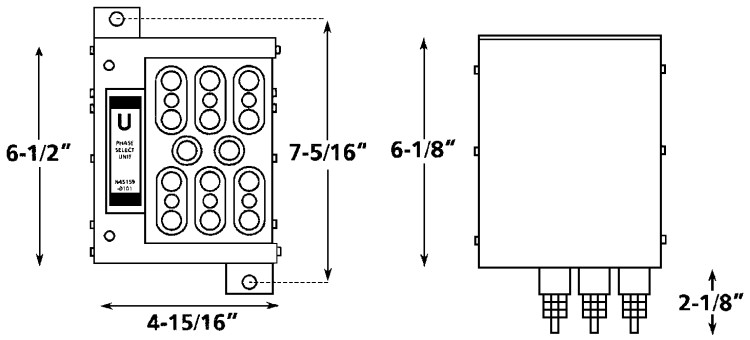
The most recent PSU incorporates several improvements over older models. These include better internal stabilization of the local input voltage and an improved means of adjusting to phase angle changes that maintains tuning frequency accuracy. Adjustment is done by adding capacitance in series with the primary of the local transformer.

Four capacitance values are available by choosing taps and changing the position of one jumper (each capacitor separately, the series combination and the parallel combination). This allows adjustment for the standard range of track circuit lengths (100 ft. to 6000 ft.)

| US&S Order Number | Description |
|---|---|
| N451590-0101 | 91.67 - 100 Hz Phase Selective Unit |

## Specifications

| | |
|---|---|
| Local Voltage: | 120 Vac rms + 5% |
| Operating Frequency: | 91.67 Hz or 100 Hz |
| Dielectric Breakdown: | 3000 V, 60 Hz or 1000 Hz |
| Temperature Range: | -40º C to ± 70º C |
| Mounting: | Rack, shelf or wall |



## Features

- Code Following Relay Drive in Power T.C.'s
- Eliminates Centrifugal Vane Relays, Line Wires, and Signal Cables
- CAB Signal Compatible, works with wide range of code rates

## Ordering Information

- Standard order number listed in chart on this page.
- To order auxiliary track circuit equipment, refer to:
  - Page 3D(1): W-400 Transformer
  - Page 8K(2): PC-250P plug-in relays N322559-014 and N322559-018

## Service Manual Reference

- Refer to **SM 6147**

# W-400 and W-800 Transformers

## General

US&S's W-400 and W-800 air cooled transformers are produced in a wide variety of input/output configurations to satisfy most requirements. These transformers, with improved efficiency over earlier models, are designed for long life and can be used for track circuit feed, signal lighting and other general applications. Special application W-400 transformers are also available for decoding and indication use.

These transformers are air cooled, consisting of a wound coil and laminations mounted in a sheet metal housing. This housing may be wall, shelf, or rack-mounted.

Coil leads are brought out to terminal posts on a molded terminal board. This board contains all transformer application information. Both primary and secondary connections are made at the top of the transformer.

The "Indication" transformer is designed for use in coded CTC systems and has one primary (two sections) and one secondary with a 0.010 inch air gap. All W-400's incorporate insulation to withstand 3000 volts RMS, have adjustable (additive) secondary windings and meet AAR standards. Request US&S Service Manual 5994 for W-400 Transformer terminal wiring configurations.

W-800 air cooled transformers supplement the W-400 transformers in applications requiring higher capacity. These transformers share all of the design and operating features of the W-400 units and are likewise suitable for a wide variety of applications. Ask for US&S Service Manual 6007 for W-800 terminal wiring configurations.

*W-400 Transformer*

*W-800 Transformer*

### Features

- T.C. Feed, Signal Lighting, and many other applications
- Dependable, consistent operation

### Ordering Information

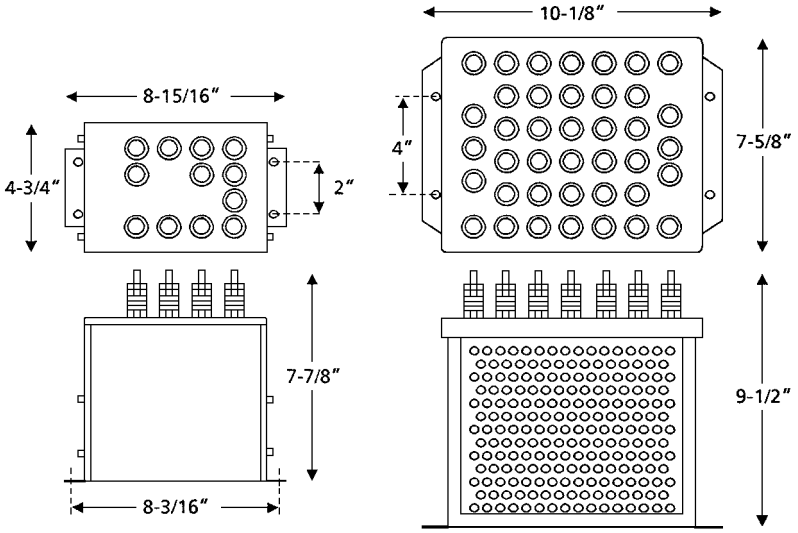
- Standard order numbers listed on next page
- Please supply all required operating specifications along with order number

### Service Manual Reference

- Refer to **SM 5994** for W-400 and **SM 6007** for W-800

**NOTE**

Please see page 3S(1) for Transformer Substitution Tables




**W-400** **W-800**

| US&S Order No. | Description | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Model | Type | Primary | | Secondary | | | Power Rating (Va. Max.) |
| | | | Voltage | Freq. (Hz) | Sec. | 1st Type | 2nd Type | |
| N451428-0101 | W-400 | Universal | 120/114 Vac | 60/100 | 1 | (18V-20A) | -- | 360 |
| N451428-0102 | W-400 | Universal | 120/114 Vac | 60/100 | 2 | (18V-20A) | (18V-20A) | 360 |
| N451428-0103 | W-400 | Universal | 120/114 Vac | 60/100 | 4 | 2(6V-3A) | (25V-5A) | 353 |
| N451428-0104 | W-400 | Universal | 120/114 Vac | 60/100 | 3 | (12V-12A) | (16V-12A) | 380 |
| N451428-0109 | W-400 | Universal | 240/228 Vac | 60/100 | 1 | (18V-20A) | 2(12V-10A) | 360 |
| N451428-0110 | W-400 | Decoding | 10 Vdc | 1.25/3 | -- | -- | -- | -- |
| N451428-0111 | W-400 | Indication | -- | -- | -- | -- | -- | -- |
| N367005-01 | W-400A | Universal | 120/114 Vac | 60/100 | 1 | (18V-20A) | -- | 366 |
| N451469-0106 | W-800 | Universal | 115/100 Vac | 25/100 | 1 | (11.5V-40A) | -- | 460 |
| N451469-0101 | W-800 | Universal | 120/114 Vac | 60/100 | 2 | (20V-18A) | (20V-18A) | 720 |
| N451469-0104 | W-800 | Universal | 120/114 Vac | 60/100 | 4 | (18.5V-10A) | 3(18.5V-10A) | 740 |
| N451469-0102 | W-800 | Universal | 240/228 Vac | 60/100 | 2 | (18V-20A) | (18V-20A) | 720 |
| N451469-0105 | W-800 | Universal | 240/228 Vac | 60/100 | 3 | (125V-5A) | 2(34V-1.74A) | 740 |

# CCR Constant Current Rectifiers

## Features

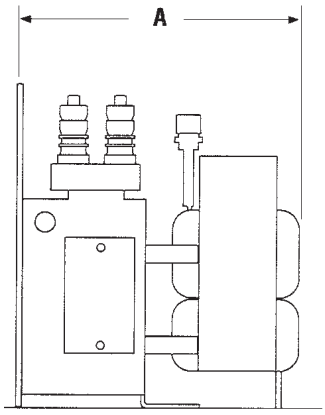
- Two Rate Charge capability
- Modular design

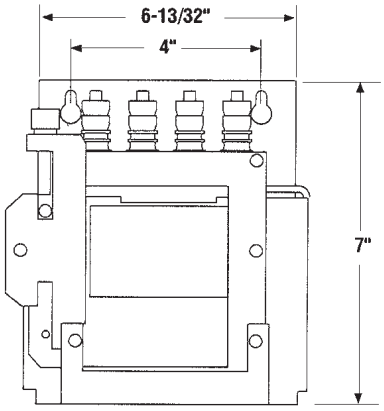
## Ordering Information

- Standard CCR unit order numbers in chart below
- Please indicate required operating specifications and model number along with order number

## Service Manual Reference

- Refer to **SM 5951**




## General

CCR Constant Current Rectifiers are used for battery charging applications where a load is connected to the battery, or for floating the battery at a lower rate when the load is disconnected. These rectifiers are self-contained, full-wave devices, each containing a reactive input transformer and full-wave diode rectifier bridge. A sliding core is employed to obtain optimum transformer operation and set the desired current levels.

The diode-rectifier bridge is bracket-mounted and easily accessible for testing and replacement. These units use a silicon avalanche integrated bridge rectifier with built-in surge protection.The versatility of the CCR series is in the selection of transformers. Each rectifier has a specially rated transformer to obtain a given output.

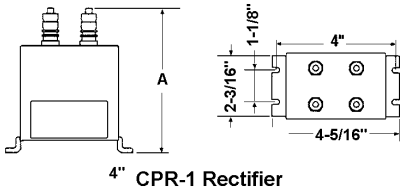
| US&S Order Number | Description | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Model | Input | | Output | | Applicable Battery* | | Dim. A |
| | | Vac | Hz | Vdc | Amps | LA-Cells | NI-Cells | |
| N451372-0101 | CCR-4 | 120/140 | 50/60 | 13.5 | 4.4 | 4-6 | 6-9 | 6" |
| N451372-0104 | CCR-5 | 120/140 | 50/60 | 3.0 | 5.0 | 1 | 1-2 | 5-1/2" |
| N451372-0107 | CCR-6 | 120/140 | 50/60 | 20.0 | 5.0 | 7-9 | 10-13 | 6-1/2" |
| N451372-0112 | CCR-7 | 120 | 60/100 | 13.5 | 6.0 | 4-6 | 6-9 | 6-1/2" |

*LA=Lead Acid Battery; NI=Nickel Iron Battery

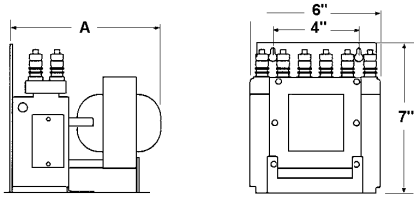
**NOTE**

See page 3S(1) for rectifier substitution tables.

# CPR Constant Potential Rectifiers




4" CPR-1 Rectifier




CPR-2, -3, and -6 Rectifiers

## General

US&S CPR Constant Potential Rectifiers are widely used for track and line applications. They provide a wide range of operating voltages to satisfy most signal and communications requirements and are intended for use with dc equipment, such as relays or other devices requiring a constant voltage source. They are not designed for battery charging applications.

Series CPR-1 Rectifiers are suitable for low power applications up to 7 watts load. Series CPR-2, -3, -4 and -6 Rectifiers are designed for loads up to 120 watts, while CPR-10 Rectifiers are for loads up to 247 watts. All CRP units are self-contained, full bridge rectifiers consisting of an input transformer and a silicon avalanche integrated bridge rectifier. These rectifiers are designed for shelf or wall mounting using standard hardware.

External wiring connections are made on AAR terminal posts to enable easy removal and installation. The operating temperature range for all units is -40º to +70º C (-40º to +160º F). All units incorporate 3000 Vac isolation between input to output chassis. Refer to the ordering tabulations below for additional specifications.

### *CPR-1*

This rectifier is enclosed in a sheet metal housing, which is fastened with two bolts to a main rectifier chassis. This housing is designed to keep dirt and debris away from the chassis. The diode rectifier bridge is mounted at the bottom center of the chassis, with the transformer directly above it.

### *CPR-2, CPR-3, CPR-4, and CPR-6*

These rectifiers have modular construction. The diode rectifier bridge is bracket-mounted and easily accessible for testing and replacement. Output voltage is adjustable over a wide range of settings by top changing of transformer windings.

The terminal block is mounted above the diode rectifier bridge, while the transformer is mounted on sleeve spacers perpendicular to the terminal board.

The versatility of this series of rectifiers is in its selection of transformers to obtain the desired operating characteristics. Each rectifier has a transformer with a specific rating, corresponding to the output. The diode rectifier is standard in all units.

### *CPR-10*

On this rectifier, the input transformer and rectifier assembly are mounted on a wrap-around frame, which can also serve as a wall-mount bracket. A separate bracket for shelf mounting is attached to the front of the unit. All circuit wiring is brought out to terminals on the top of the assembly.

Different output voltages are created by making circuit changes on these terminals. Circuit changes to accommodate two input voltages are also made on these terminals.

## Features

- Ideal for track and line applications
- Adjustable output voltage on selected units
- High efficiency operation

## Ordering Information

- Standard CPR Series rectifier order numbers listed in chart on next page
- Please indicate required operating specifications and model number along with order number

## Service Manual Reference

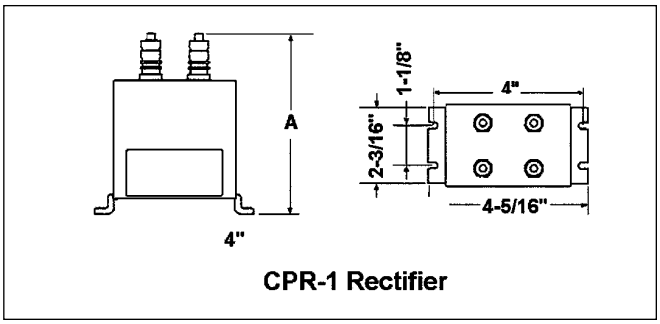
- Refer to **SM 5952**

**NOTE**

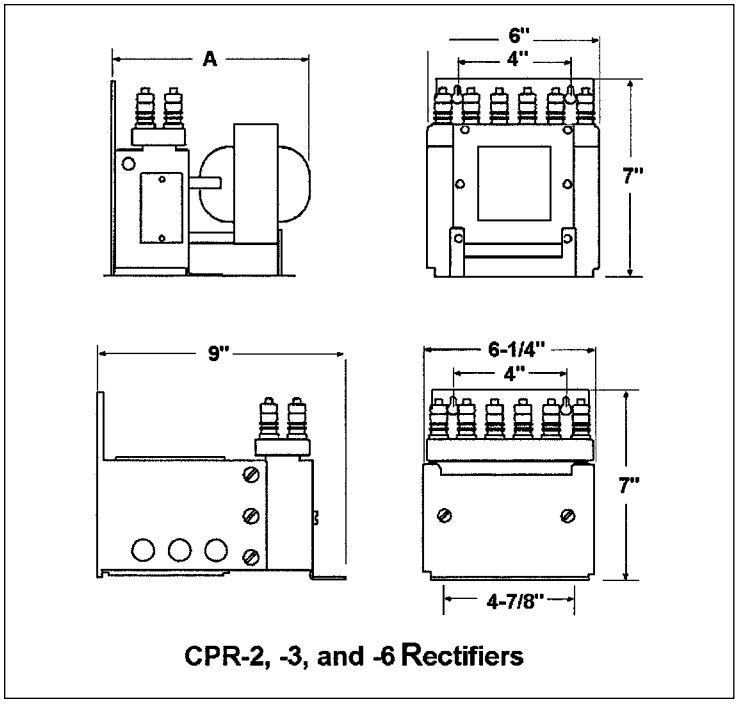
See page 3S(1) for Rectifier Substitution tables

| US&S Order Number | Description | | | | | | |
|---|---|---|---|---|---|---|---|
| | CPR- | Input | | Output | | Dim. "A" | Notes |
| | | Vac | Hz | Vdc | Amps | | |
| N451372-0302 | 1 | 110.0 | 25/100 | 10.0 | 0.06 | 4-31/32" | -- |
| N451372-0303 | 1 | 15.0 | 25/100 | 12.0 | 0.10 | 4-23/32" | -- |
| N451372-0304 | 1 | 110.0 | 25/100 | 12.0 | 0.10 | 4-31/32" | -- |
| N451372-0305 | 1 | 110.0 | 60/100 | 16.0 | 0.10 | 4-31/32" | -- |
| N451372-0306 | 1 | 1.44 | 60 | 4.0 | 0.20 | 4-29/32" | -- |
| N451372-0307 | 1 | 9.2 | 25/100 | 13.0 | 0.50 | 5-11/32" | -- |
| N451372-0310 | 1 | 115.0 | 60/100 | 16.0 | 0.20 | 5-11/32" | -- |
| N451372-0501 | 4 | 115/120 | 60/100 | 10.0-18.0 | 4.0 | 6-27/32" | 1 |
| N451372-0502 | 3 | 110/115 | 25/100 | 10.0-17.5 | 3.0 | 7-11/32" | 1 |
| N451372-0503 | 2 | 110/115 | 50/100 | 27.0-60.0 | 2.0 | 7-11/32" | 2 |
| N451372-0504 | 6 | 115/120 | 50/100 | 12.5-20.0 | 6.5 | 7-11/32" | 3 |
| N451372-0505 | 10 | 120/114 | 60/100 | 10.0-16.5 | 15.0 | -- | 1 |

**NOTES** 1-Adjustable in 0.5 volt steps 2-Adjustable in 2.0 volt steps
3-Adjustable in 0.8 volt steps




**CPR-1 Rectifier**




**CPR-2, -3, and -6 Rectifiers**

UNION SWITCH & SIGNAL

3G(1)
Rev. 5/97

# Track Reactors

*High Side Track Reactor*

## Specifications

***VT-6 Low Side Reactor***

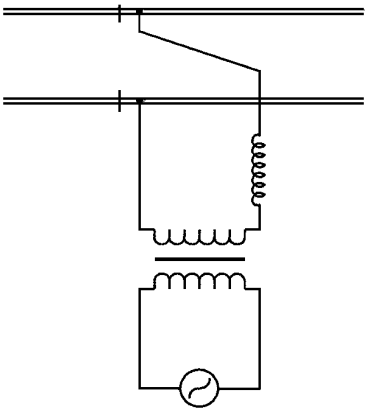
| | |
|---|---|
| *Frequency:* | 50, 60 or 100 Hz |
| *Air Gap:* | .026 in. |
| *Taps:* | 6 terminals, 12 tap pairs |

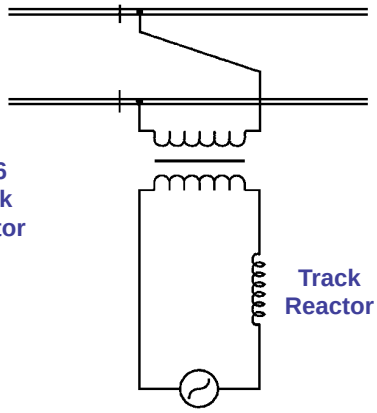
***Track Reactor***

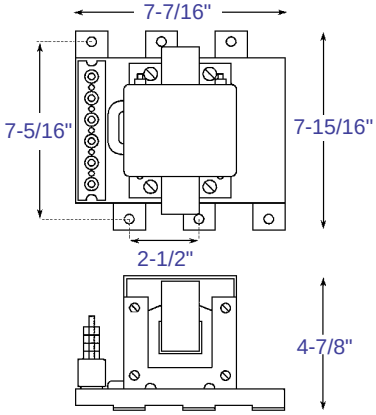
| | |
|---|---|
| *Current:* | 3.0 A RMS (max.) |
| *Frequency:* | 25, 60, 100 or 200 Hz |
| *Taps:* | 3 terminals, 3 tap pairs |

## General

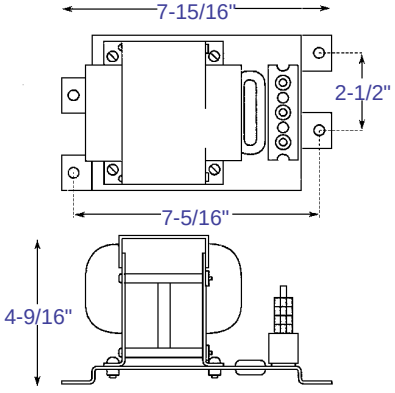
US&S's track reactors are used as track circuit feed reactors that provide phase shift and current limiting for AC signal applications. The VT-6 is a low side reactor, while a high-side reactor is also available. Both are designed for standard rail mounting, using a heavy gauge sheet steel base. Coil wiring is routed to the AAR terminals, which serve as connection points for various tap combinations. The topside nameplate on each unit tabulates resistance and maximum voltage at different AC frequencies available on different taps.




VT-6 Track Reactor




Track Reactor

## Features

- Suitable for all low side and high side applications

## Ordering Information

- Standard ordering numbers listed below

| US&S Order Number | Description |
|---|---|
| N451036-1301 | Low Side Track Reactor |
| N451036-1501 | High Side Track Reactor |

# RC-1 Track Rectifier

## General

The RC-1 track rectifier is used in US&S type "C" track circuits as a shunting device.

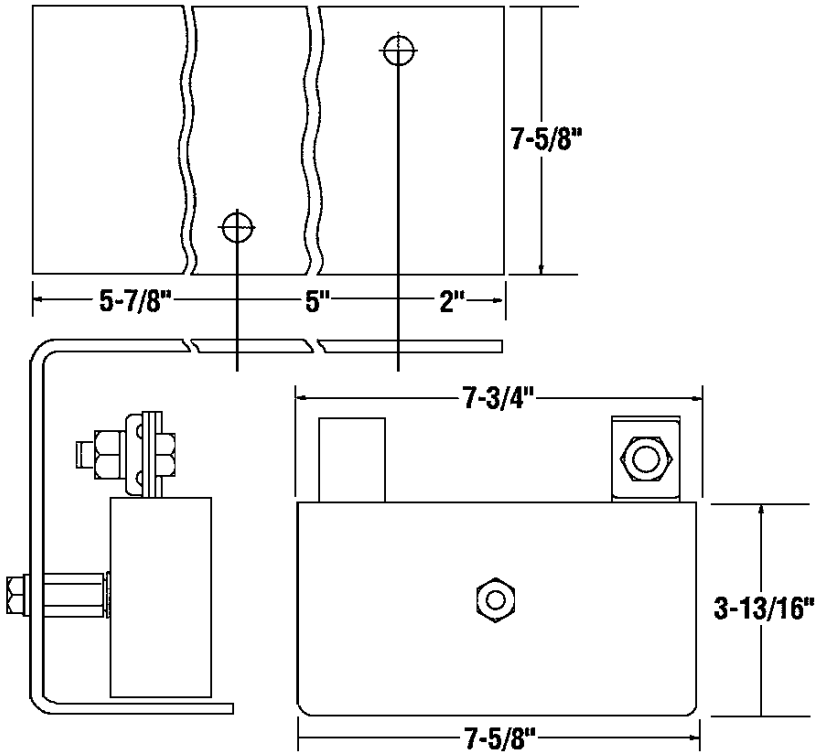
In these track circuits, a dc relay is connected across a rectified ac power source which, in turn, is connected to the rails. This ac signal energizes the relay. The RC-1 provides a halfwave shunt across the dc relay coil when a train enters the track circuit. As a result, the dc relay receives a lower power ac wave, and the combination of events de-energizes the relay, thus initiating the grade crossing warning events.

Each RC-1 rectifier assembly incorporates a 16 amp, 400 PRV silicon diode rectifier unit. This unit is attached to the tires with a single-piece mounting bracket. Track circuit cabling is connected to clamp type terminal posts on the rectifier unit.

## Features

- Serves essential role in Type "C" track circuits

| US&S Order Number | Description |
|---|---|
| N393974 | RC-1 track rectifier |
| N393795 | RC-1 mounting bracket |



# F-81 DC/AC Inverter

## General

The F-81 Inverter is a fully solid state unit designed to convert direct current into alternating current at high efficiency for applications such as cab signals and standby ac power sources. This unit eliminates the mechanical vibrators of earlier inverters, yielding a unit of exceptional reliability and stability over a wide temperature range.

The F-81 is housed in a compact steel enclosure with easily accessible terminal posts located along a “shelf” at the front of the unit. Conversion from direct to alternating current is accomplished by a solid state inverter oscillator circuit and tapped output transformer. The tapped transformer enables quick and easy adjustment of output voltage to system requirements. Short circuit protection is built-in and standard for all models.

## Features

- Ideal as standby ac power source
- Stable output frequency, high efficiency
- No mechanical vibrator
- Note replacement cross reference for older F-30 and F-80 inverters

## Service Manual Reference

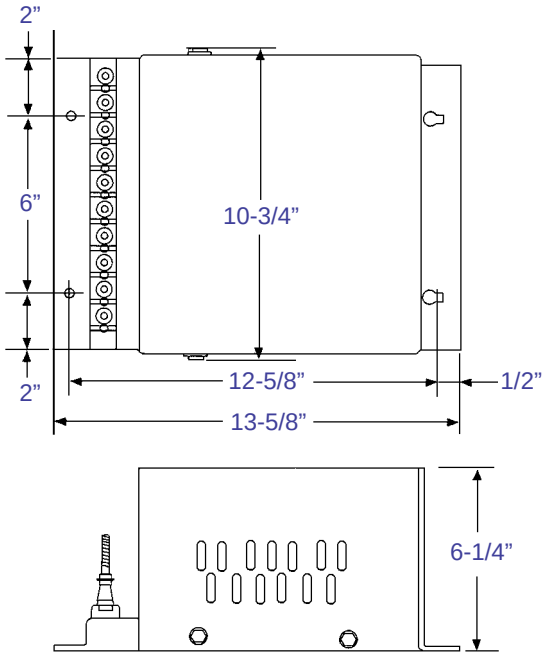
- Refer to **SM 6128**

## Specifications

| | |
|---|---|
| ***Input Voltage*** | 12 Vdc |
| ***Input Current*** | 30 A |
| ***Output Voltage*** | 120 Vac (15-15-15-15-50-5-5) |
| ***Output Volt/Amps*** | 300 VA (average power) |
| ***Output Frequency*** | N451033-4001: 60.0 Hz / N451033-4002: 100.0 Hz |
| ***Operating Temperature*** | -40ºC to +70ºC |

## Replacement Table

| US&S Order Number | F-30 | *replaces* | F-80 |
|---|---|---|---|
| N451033-4001<br>N451033-4002 | N382592<br>N390490 | | N451033-3403<br>N451033-3404 |



# F-82 DC/AC Inverter

## General

The all solid state F-82 Inverter can be used as the low-voltage power source for up to four Type “C” track circuits. This unit normally operates from 120 Vac commercial power, but automatically transfers to standby batteries in the event ac power is lost. Input power transfer is accomplished within the F-82 unit; external transfer circuitry is not required.

In the standby operating mode, the unit converts dc to ac at high efficiency to minimize battery drain. All components are housed in a rugged sheet steel enclosure designed for shelf or wall mounting. Terminals are located on a convenient “shelf” at the unit’s front.

## Specifications

| | |
|---|---|
| ***Input Voltage*** | 120 Vac (normal)<br>12 Vdc (standby) |
| ***Input Current*** | 1 A maximum (normal)<br>10A maximum (standby) |
| ***Output Voltage*** *(track)* | 5.5 Vac (normal)<br>6.5 Vac (standby) |
| ***Output Amps*** | 3.5 A/secondary (normal) Sine waves/secondary<br>3.5 A/secondary (standby) Square waves/secondary |
| ***Temp. Range*** | -40ºC to +70ºC |

## Features

- Designed for Type “C” track circuit operations
- Stable under extreme temperature variations

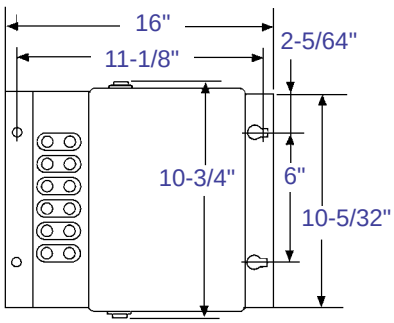
## Ordering Information

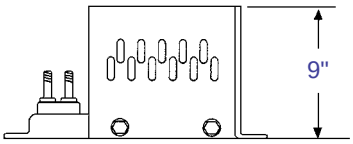
- Standard F-82 order numbers below
- Refer to page 3H(1) for RC-1 rectifier used in type “C” track circuits

## Service Manual Reference

- Refer to **SM 6137**

| US&S Order Number | Description |
|---|---|
| N451033-4101 | F-82 Inverter |



# F-85 Inverter-Driver

## Features

- High precision output
- Phase-selective track circuit and other applications
- Models for all standard output signals.

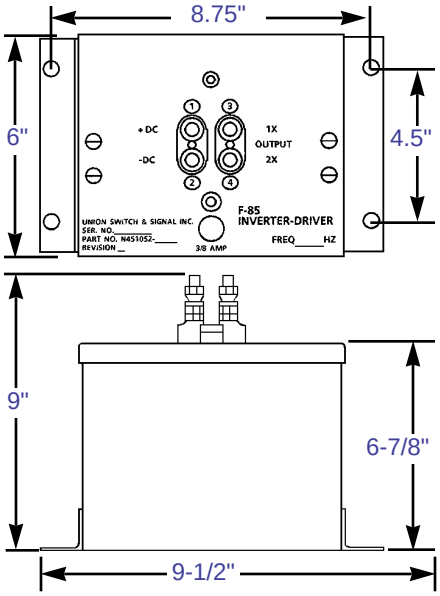
## Ordering Information

- Standard F-85 order numbers listed in chart below
- Please specify required frequency along with order number
- Contact US&S Sales to order F-85 units with special frequencies

## Service Manual Reference

- Refer to **SM 6306** and **6307**

| US&S Order Number | Description |
|---|---|
| N451052-4303 | F-85 Inverter-Driver, 100.0 Hz |




## General

The F-85 Inverter-Driver is a highly reliable signal generator designed for use in phase selective track circuits or any other application requiring a precise and predictable signal output. It is typically used with the US&S F50-1 Inverter Follower to produce a standard signal 100 Hz over a 9 to 18 V supply voltage range.

Depending upon the application, F-85 units can also be developed with customer specified frequencies. The F-85 is provided as a direct replacement for the F-70 Inverter-Driver (N451034-680X).

Components of the F-85 are housed in a 2-piece sheet metal case with two mounting brackets. Power input and signal output connections are made on four AAR standard terminals located on top of the case. The unit's input power fuse is also accessible on the front cover.

The case contains two printed circuit boards, the Logic and Output PCB's, which are hard-wired to the external terminals and fuse. A quartz crystal controlled oscillator on the Logic PCB provides the base frequency for the unit's output. Dual countdown stages on this board provide precisely phased signals to the Output PCB. This board contains summing circuits and amplifiers that receive and process the phased outputs from the Logic PCB.

An output transformer on the Output PCB yields the desired square wave signal. An on-board fuse (separate from the font-panel power fuse) is used to cut off the output signal in the event of an out-of-tolerance deviation in the signal.

## Specifications

| | |
|---|---|
| ***Input Voltage*** | 9.0 to 18.0 Vdc, 12.0 Vdc nom. |
| ***Output Frequency*** | 100.0 Hz ± 1.0 Hz |
| ***Load Impedance*** | 390 ohms, nominal |
| ***Output Power*** | 8.0 volts minimum (16 V P-P) across 39 ohms - 160 milliwatts |
| ***Temperature Limits*** | -30º to 160º F. |
| ***Reverse Batt. Protection*** | Built-in |
| ***Breakdown Voltage*** | 3000 volts@60 Hz |

UNION SWITCH & SIGNAL

3M(1)
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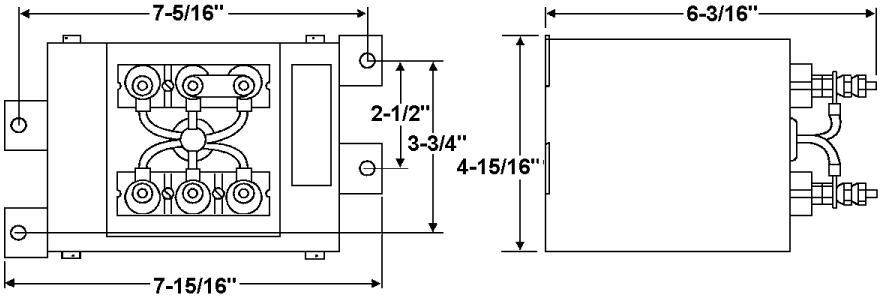
# Surge Ripple Filter




## Features

- Ideal for AFO track circuits and other installations
- Design improvements yield very high reliability

## Ordering Information

- Standard filter order numbers listed in chart below
- Make certain the intended application does not exceed the 2.5A current limit for the unit

## Service Manual Reference

- Refer to **SM 6265**

| US&S Order Number | Description |
|---|---|
| N451590-0301 | Surge Ripple Filter, 2.5A load |

## General

The Surge Ripple Filter provides dependable and long-lasting protection for many classes of electronic equipment such as audio frequency overlay devices. It guards against lightning and other types of power surges, and also aids in reducing voltage ripple caused by battery chargers.

This particular unit improves upon previous filters with its solid-state transient voltage suppressor, and new redundant capacitive filter circuit. As a result, the new Surge Ripple Filter works with unprecedented reliability. Ripple reduction is accomplished with a simple LC circuit consisting of the inductor and the two capacitors. The capacitors are placed in a redundant configuration to insure filtering should one of them fail. Transient voltage suppression is achieved with an inductor, the Transzorb, and an externally mounted lightning arrester (not included).

This model of the Surge Ripple Filter is a direct replacement for older units N451036-0701 and N451036-0702.

# USG-A Lightning Arresters

## Features

- State-of-Art lightning protection
- Models for high and low voltage dc, ac line
- Easy to inspect
- New “green” arrester for special applications

## Ordering Information

- Standard USG-A arrester units and terminal mount kits listed below
- Order terminal block and mounting hardware separately for low voltage green arrester

## General

USG-A Lightning Arresters reduce the chances of damage to electrical and electronic equipment from lightning strikes. As a result, they help minimize disruptions and equipment down time. These units incorporate the latest in lightning arrester technology and are available in several models to satisfy most applications, including high voltage, low voltage and ac line.

USG-A Lightning Arresters are designed to limit surge voltage transients on electrical equipment below breakdown voltage, and minimize surge current through the equipment. They are provided as separate units, or are mounted on a terminal block. Typical applications are shown in the illustration on the next page.

The standard low voltage arrester is a varistor filled gap arrester. The varistor material is in parallel with a high durability air gap formed by the separation of two brass disks. Static charges are bled off by the varistor, and fast-rising transients are immediately clipped with a minimum of overshoot.

US&S’s new low voltage green arrester is provided for those stringent applications where the minimum possible clamping voltage must be assured. Each green arrester is meticulously tested for this purpose. As shown in the specifications chart on the next page, the green arrester clamps a 1000 volt dynamic surge to 250 - 450 volts peak. This is typically 100 volts lower than a blue arrester subjected to the same dynamic test.

The high voltage arrester is a true air gap arrester. The gap is physically held by a Teflon spacer and is in series with a varistor, making it a current limiting gap. This arrangement is in parallel with the gap formed by the separation of the brass disks.

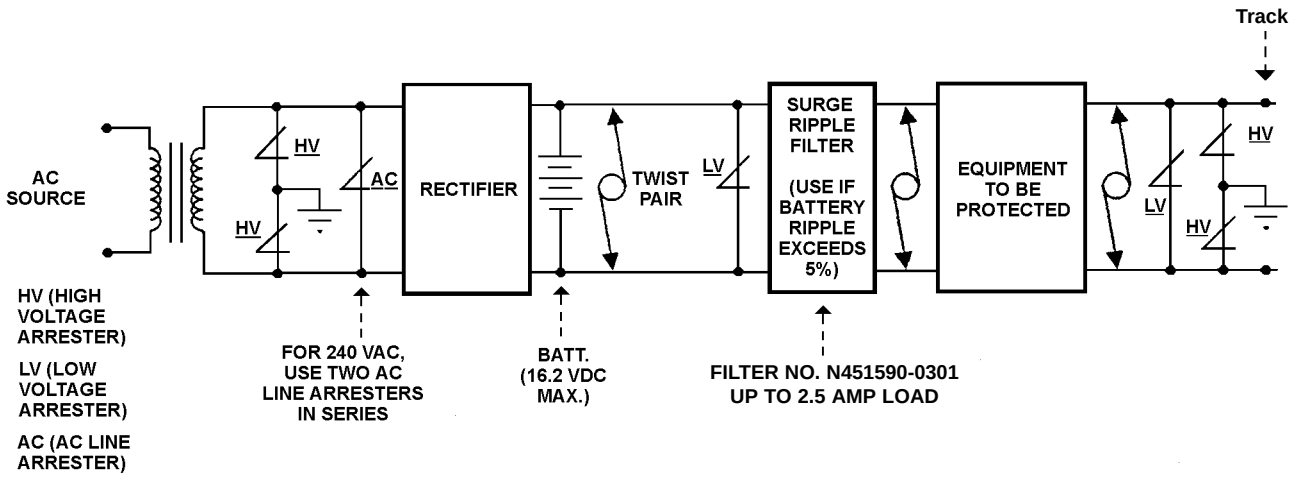
USG-A E-Z Vue Lighting Arresters are equipped with a high strength, clear Lexan cover that permits visual inspection of internal components, and contains the explosive effects of heavy surges. Part numbers are stenciled and color coded for quick identification of different units.

| US&S Order No. | Description |
|---|---|
| N451552-0101 | USG-A arrester unit, low voltage type (blue) |
| N451552-0103 | USG-A arrester unit, low voltage type (green) |
| N451552-0201 | USG-A arrester unit, high voltage type (red) |
| N451552-0401 | USG-A arrester unit, AC line type (yellow) |
| X451552-0301 | Low Voltage Arrester, with AAR terminal block and mtg. hardware |
| X451552-0302 | High Voltage Arrester, with AAR terminal block and mtg. hardware |
| X451552-0306 | AC Line Arrester, with AAR terminal block and mtg. hardware |

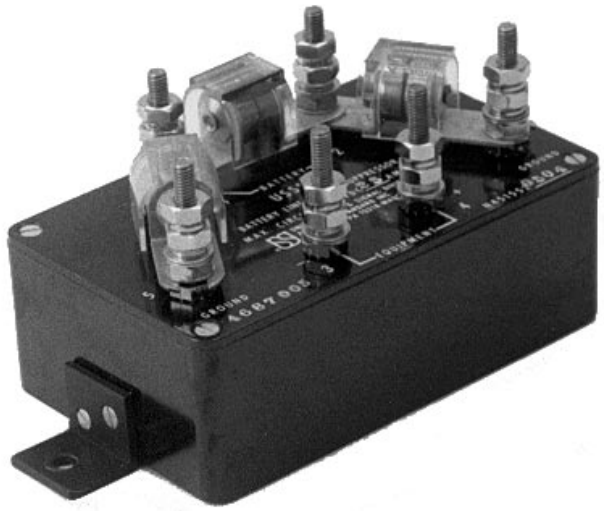
## Specifications

***Static Operating Parameters***

| | |
|---|---|
| *Operating Voltages* | Low Voltage (blue and green): 32 Vdc, 25 Vac<br>AC Line (yellow): 140 Vac<br>High Voltage (red): 250 Vdc, 175 Vac, |
| *Breakdown Voltage* | Low Voltage (blue and green): 75-200 Vdc,<br>50-100 Vac (60 Hz)<br>High Voltage (red): 500-3000 Vdc, 350 - 950 Vac |
| *Resistance* | Low Voltage (blue and green): $\geq 10^9$ ohms @ 32 Vdc<br>AC Line (yellow): $\geq 5 \times 10^3$ ohms @120 Vac<br>High Voltage (red): $\geq 10^9$ ohms @ 100 Vdc |
| *Dynamic Wavefront* | 1000 VPEAK 10kV/usec rise rate |
| *Peak Voltage* | 250 to 450VPEAK |



# USSP Secondary Surge Suppressors



## Features

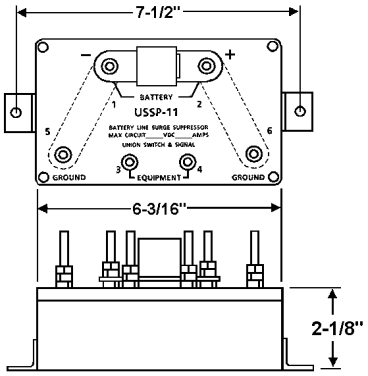
- Helps protect sensitive electronic equipment from power surges
- Wide range of battery, track and ac line options
- New versions for non-electrified track circuits

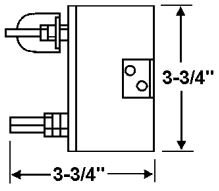
## Ordering Information

- Standard USSP order numbers listed in chart on next page
- Please indicate required operating specifications along with order number
- Refer to page 3N(1) to order additional USG-A lightning arresters for the USSP units.

## Service Manual Reference

- Refer to **SM 6145**




## General

US&S Secondary Surge Suppressors (USSP) help protect many types of solid-state equipment by limiting electrical surges to this equipment. This is accomplished with solid state suppression and inductance coil circuits and various configurations of primary arresters. Different USSP units cover track circuit, power line and battery line applications. All are easy to install.

The basic USSP unit (not including external primary arresters) is designed to limit low energy transients and surges that are of insufficient amplitude to break over the primary arresters, but can still damage sensitive electronic equipment.

A series inductor in each leg of a USSP is common to all of these units. The inductors provide isolation impedance between the primary and secondary suppressors. Various clamping devices are used in conjunction with inductors to limit the differential line-to-line voltages. These include Zener diodes, varistors and unipolar and bipolar TransZorbs. Request US&S Service Manual 6145 for typical applications, complete schematic diagrams and component specifications for all USSP units. Refer to the ordering tabulation below for USSP operating specifications.

Each USSP unit is housed in a high-dielectric plastic case with mounting tabs at each end. Circuit protective components, internal wiring and standard AAR terminals are fastened to the unit's cover; this allows fast disassembly for inspection purposes. The top of the cover is clearly marked with vital unit operating specifications and terminal nomenclature. Selected models of the USSP are equipped with the US&S USG-A Lightning Arrester, which provides primary voltage surge protection.

Unit N451552-0534 is designed for use in non-electrified track circuits and track circuits on dc-electrified territories.

| US&S Order Number | USSP No. | Type | Description | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Maximum Circuit | | | Coil Ind. (MH) | Capac. | | Secondary Suppress* | USG-A Arresters (N451552-) | |
| | | | VDC | VAC | Amps | | MFD | Volts | | Order No. (Qty.) | |
| N451552-0501 | 11 | Batt. | 18 | -- | 3 | 150 | 100 | 25 | 18.8 VdcZ | -0101(1) | -0201(2) |
| N451552-0502 | 11 | Batt. | 18 | -- | 7 | 22 | 100 | 25 | 18.8 VdcZ | -0101(1) | -0201(2) |
| N451552-0503 | 11 | Batt. | 18 | -- | 15 | 16 | 100 | 25 | 18.8 VdcZ | -0101(1) | -0201(2) |
| N451552-0504 | 11 | Batt. | 18 | -- | 25 | 5 | 100 | 25 | 18.8 VdcZ | -0101(1) | -0201(2) |
| N451552-0506 | 10 | Batt. | 18 | -- | 7 | 22 | 100 | 25 | 18.8 VdcZ | -0101(1) | |
| N451552-0507 | 10 | Batt. | 18 | -- | 15 | 16 | 100 | 25 | 18.8 VdcZ | -0101(1) | |
| N451552-0508 | 10 | Batt. | 18 | -- | 25 | 5 | 100 | 25 | 18.8 VdcZ | -0101(1) | |
| N451552-0511 | 10 | Batt. | 18 | -- | 15 | 16 | 100 | 25 | 18.8 VdcZ | | -- |
| N451552-0513 | 11 | Batt. | 32 | -- | 3 | 150 | 100 | 55 | 33.3 VdcZ | | -- |
| N451552-0514 | 11 | Batt. | 32 | -- | 7 | 22 | 100 | 25 | 33.3 VdcZ | -0101(1) | -0201(2) |
| N451552-0515 | 11 | Batt. | 32 | -- | 15 | 16 | 100 | 55 | 33.3 VdcZ | -0101(1) | -0201(2) |
| N451552-0516 | 11 | Batt. | 32 | -- | 25 | 5 | 100 | 55 | 33.3 VdcZ | -0101(1) | -0201(2) |
| N451552-0518 | 10 | Batt. | 32 | -- | 7 | 22 | 100 | 55 | 33.3 VdcZ | -0101(1) | |
| N451552-0523 | 10 | Batt. | 32 | -- | 15 | 16 | 100 | 55 | 33.3 VdcZ | | -- |
| N451552-0525 | 21 | Track | 7 | 17 | 50 | 5 | 100 | 55 | 31.6 VdcZ | -0101(1) | -0201(2) |
| N451552-0527 | 20 | Track | 7 | 17 | 50 | 5 | 100 | 55 | 31.6 VdcZ | | -- |
| N451552-0528 | 30 | AC | -- | 120 | 20 | 8 | 100 | 55 | 140 VacZ | -01401(1) | |
| N451552-0529 | 31 | AC | -- | 240 | 20 | 8 | 100 | 55 | 275 VacZ | -01401(2) | |
| N451552-0534 | 20 | Track | 63 | -- | 50 | 5 | -- | -- | 63.2 VdcZ** | -201(2) | -- |

*Z = Zener  V = Varistor  BPT = Bipolar TransZorb (peak voltage listed)  **Two Zener diodes connected in series

UNION SWITCH & SIGNAL

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# TSS-101 Track Surge Suppressor

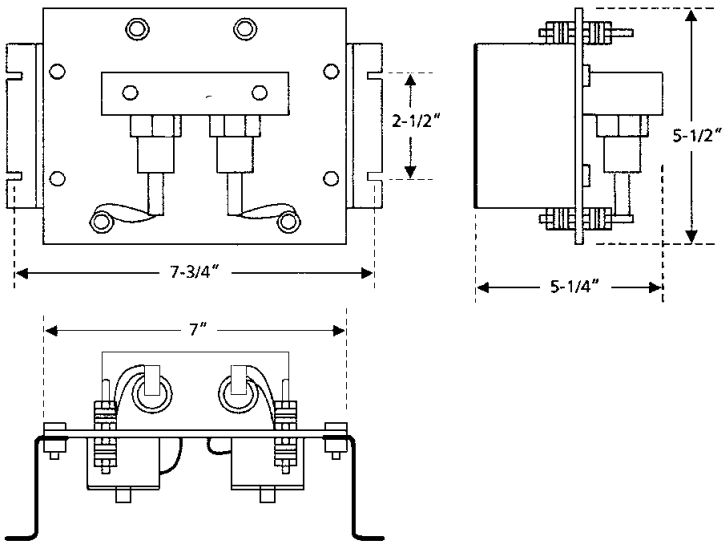
## General

The US&S TSS-101 Track Surge Suppressor incorporates the latest advancements in secondary surge protection research. This device is especially well suited for protection of wayside track circuit control equipment with highly sensitive microprocessor-based, software controlled logic.

Each TSS-101 uses two air core inductors on the track input side (+ and -) to eliminate saturation problems that limit the effectiveness of other secondary surge suppressors. The clamping devices used in the TSS-101 are back-to-back power Zener diodes built for transient protection. These devices have a maximum clamping level of 54 volts. At least 640 amperes must be passed through the diodes to reach the 54 volt level, well above expected secondary surge levels.

Inductance and surge suppression components of the TSS-101 are mounted on a single, heavy-duty terminal board. The board also mounts four AAR terminals for track and equipment wiring. Brackets are provided for shelf, wall or direct mounting to the equipment under protection.

(Note: As a secondary protector, the TSS-101 should be installed as close as possible to the equipment under its protection.)




## Features

- State-of-the-Art track circuit surge protection
- Simple but very reliable
- Superb service record

## Ordering Information

- Contact US&S Sales when ordering for new wayside control systems
- Standard TSS-101 ordering number listed in chart below

| US&S Order Number | Description |
|---|---|
| N451552-0901 | TSS-101 Track Surge Suppressor |

## Specifications

| | |
|---|---|
| ***Input Voltage*** | 30 Vdc (max.) |
| ***Current Rating*** | 15 A (max.) |
| ***Coil Inductance*** | 100 uH |
| ***Coil Resistance*** | .043 Ohms |
| ***Surge Suppression*** | 1 amp conduction at approximately 35 Vdc |

UNION SWITCH & SIGNAL

3Q(1)
Rev. 5/97

# CMF-101 Common Mode Filter

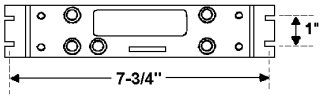
## Features

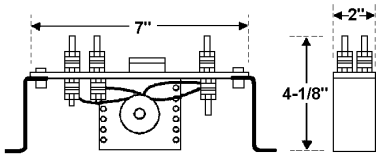
- Eliminates common mode line noise
- Battery or track applications
- Outstanding service record

## Ordering Information

- Contact US&S Sales when ordering for new wayside control systems.
- Standard TSS-101 ordering number is listed in the chart below.
- CMF-101 units can be ordered with different capacitance values per the application.

| US&S Order No. | Description |
|---|---|
| N451552-1001 | CMF-101 Common-Mode Filter |



## General

The US&S CMF-101 Common Mode Filter is a new class of line filter designed to mitigate noise of equal phase and amplitude appearing on a line pair and referenced to a “ground”.

The common mode noise is becoming more prevalent in the railroad environment with the increased use of switch mode power supplies and battery chargers, as well as radios, power line effects, and other “noisy” peripheral equipment. This type of noise has always been present, but has become more evident with the increased use of microprocessor-based electronics.

The CMF-101 is designed primarily for noise mitigation in the 10 KHz to 500 KHz region. The filter consists of a special ferrite toroid that is wound in such a way as to block only common mode noise components, without affecting normal signals. Each line is by-passed to ground via a capacitor-fuse combination.

**NOTE** The CMF-101 should be mounted as close as possible to the equipment under its protection, with care taken to separate the “clean” and “dirty” sides of the filter wiring. If secondary transient protection (such as the TSS-101) is used, the CMF-101 should be physically and electrically located closest to the equipment.

## Specifications

***Input***

| | |
|---|---|
| *Line Current* | 15 A (max.) |
| *Line-to-line voltage* | 1000Vdc (max.) |
| *Line-to-ground voltage* | 1000Vdc (max.) |

***Coil Induct***

| | |
|---|---|
| *Common-mode* | 1.6 MH |
| *Differential mode* | <10 uH |

***Capacitance***

| | |
|---|---|
| *Line-to-ground* | .022 uF |
| *Fuse-to-ground* | 1 A Fast-Blo, 3 AG |

# Rectifier Cross Reference Table

## General

The tabulations in this section are provided to enable direct replacement of older style US&S rectifiers with the model CCR and CPR rectifiers. As shown in the first tabulation, specific types of the CCR replace RT series rectifiers. Specific CPR models replace older HQ, RP, RQ and SQ rectifiers.

Contact US&S Sales to select the proper CCR and CPR replacement for any other rectifier not shown in the tabulations.

| CCR Rectifiers | | |
|---|---|---|
| Old Rectifier | | CCR/CPR Order Number |
| Type | Number | |
| RT5 | N213766 | N451372-0101 |
| RT5 | N213767 | N451372-0101 |
| RT10 | N219633 | N451372-0101 |
| RT10 | N219634 | N451372-0101 |
| RT10 | N221010 | N451372-0101 |
| RT10 | N221011 | N451372-0101 |
| RT10 | N224450 | N451372-0101 |
| RT11 | N209656 | N451372-0107 |
| RT11 | N213288 | N451372-0107 |
| RT11 | N219695 | N451372-0101 |
| RT11 | N342232 | N451372-0101 |
| RT11 | N192631 | N451372-0107 |
| RT21 | N192634 | N451372-0107 |
| RT21 | N212967 | N451372-0107 |
| RT21 | N222105 | N451372-0107 |
| RT21 | N222106 | N451372-0101 |
| RT21 | N395116 | N451372-0101 |
| RT21 | N119366 | N451372-0101 |
| RT42 | N196563 | N451372-0107 |
| RT42 | N207224 | N451372-0101 |
| RT42 | N207275 | N451372-0107 |
| RT42 | N207275 | N451372-0107 |
| RT42 | N207918 | N451372-0107 |
| RT42 | N208287 | N451372-0107 |
| RT42 | N219581 | N451372-0107 |
| RT42 | N225355 | N451372-0101 |
| RT42 | N230204 | N451372-0101 |
| RT42 | N235543 | N451372-0107 |
| RT81 | N188955 | N451372-0107 |
| RT81 | N190852 | N451372-0107 |
| RT81 | N194650 | N451372-0101 |
| RT81 | N227282 | N451372-0101 |

| CPR Rectifiers | | |
|---|---|---|
| Old Rectifier | | CCR/CPR Order Number |
| Type | Number | |
| RT81S | N341040 | N451372-0112 |
| R3T-104 | N107979 | N451372-0104 |
| R3T-104 | N107982 | N451372-0104 |
| R3T-104 | N108918 | N451372-0104 |
| R3T-104 | N291952 | N451372-0104 |
| R3T-104 | N292290 | N451372-0104 |
| R3T-204 | N216648 | N451372-0104 |
| R3T-04 | N217044 | N451372-0104 |
| HQ180D | N337707 | N451372-0503 |
| HQ108P | N273098 | N451372-0502 |
| HQ7C | N334090 | N451372-0307 |
| HQ7C | N388513 | N451372-0310 |
| RPQ21 | N162875 | N451372-0504 |
| RPQ21 | N185711 | N451372-0505 |
| RPQ42 | N221103 | N451372-0504 |
| RPQ42 | N231960 | N451372-0504 |
| RPQ42 | N306987 | N451372-0504 |
| RPQ44 | N316387 | N451372-0505 |
| RPQ61 | N210802 | N451372-0505 |
| RQ5 | N160849 | N451372-0303 |
| RQ5 | N181324 | N451372-0302 |
| RQ5 | N189784 | N451372-0301 |
| RQ5 | N196068 | N451372-0304 |
| RQ7 | N285970 | N451372-0305 |
| RQ8 | N212635 | N451372-0306 |
| RQ10 | N164362 | N451372-0302 |
| RQ12 | N147452 | N451372-0502 |
| RQ12 | N210643 | N451372-0502 |
| RQ12 | N210938 | N451372-0502 |
| RQ12 | N286233 | N451372-0502 |
| RQ21 | N163618 | N451372-0501 |

| CPR Rectifiers | | |
|---|---|---|
| Old Rectifier | | CCR/CPR Order Number |
| Type | Number | |
| RQ21 | N210642 | N451372-0502 |
| RQ21 | N211986 | N451372-0501 |
| RQ21 | N286234 | N451372-0501 |
| RQ21 | N322820 | N451372-0502 |
| RQ22 | N176066 | N451372-0501 |
| RQ22 | N186488 | N451372-0502 |
| RQ22 | N255325 | N451372-0503 |
| RQ22 | N260586 | N451372-0501 |
| RQ22 | N327674 | N451372-0503 |
| RQ22 | N333986 | N451372-0503 |
| RQ30 | N195410 | N451372-0503 |
| RQ41 | N184642 | N451372-0503 |
| RQ41 | N196250 | N451372-0503 |
| RQ41 | N199289 | N451372-0502 |
| RQ41 | N286236 | N451372-0502 |
| RQ53 | N196418 | N451372-0503 |
| RQ60 | N188693 | N451372-0504 |
| R3Q260 | N255949 | N451372-0502 |
| R3Q206 | N297499 | N451372-0502 |
| R3Q206 | N306224 | N451372-0502 |
| R3Q208 | N212991 | N451372-0502 |
| R3Q208 | N219974 | N451372-0502 |
| R3Q406 | N255950 | N451372-0504 |
| R3Q406 | N306233 | N451372-0504 |
| R3Q408 | N214586 | N451372-0502 |
| R3Q408 | N261161 | N451372-0504 |
| R3Q409 | N242486 | N451372-0504 |
| R3Q416 | N225229 | N451372-0504 |
| SQ116P | N273110 | N451372-0502 |
| SQ116P | N273475 | N451372-0502 |
| SQ216P | N321358 | N451372-0501 |

# Transformer Cross Reference Table

## General

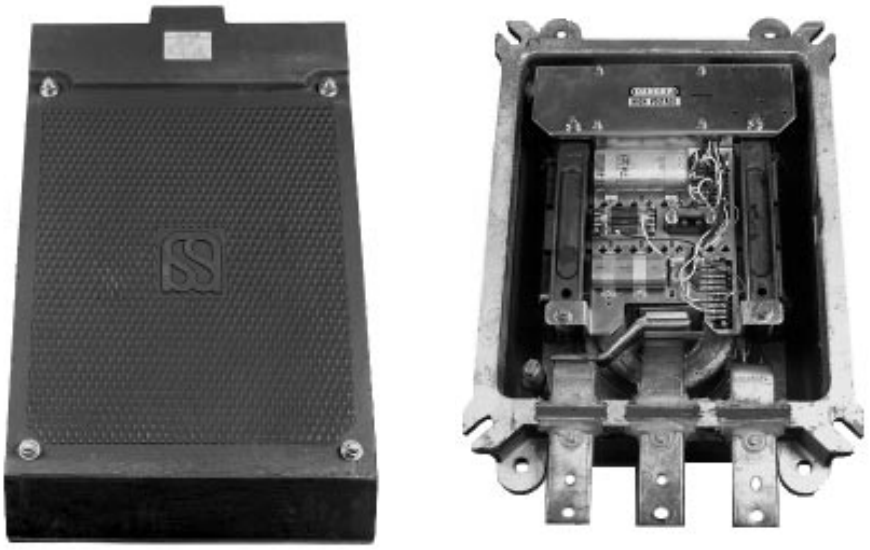
The tabulations in this section are provided to enable direct replacement of older style US&S rectifiers with the model W-400 and W-800 transformers. As shown in the first table, specific types of the W-400 replace W-5, W-7, W-10, and W-11 Transformers. Specific W-800 models replace older W-20 transformers. Contact US&S Sales to select the proper W-400 or W-800 replacement for any other transformer not shown in the tabulations.

| W-400 Transformers | | |
|---|---|---|
| Old Transformer | | W-400 Order Number |
| Type | Number | |
| W-5 | N107000 | N451428-0102 |
| W-5 | N218750 | N451428-0102 |
| W-5 | N231050 | N451428-0102 |
| W-5 | N273481 | N451428-0102 |
| W-7 | N219972 | N451428-0110 |
| W-7 | N226832 | N451428-0111 |
| W-10 | N156455 | N451428-0101 |
| W-10 | N161894 | N451428-0101 |
| W-10 | N162844 | N451428-0101 |
| W-10 | N163619 | N451428-0109 |
| W-10 | N169294 | N451428-0106 |
| W-10 | N175942 | N451428-0102 |
| W-10 | N210906 | N451428-0103 |
| W-10 | N214358 | N451428-0104 |
| W-10 | N230595 | N451428-0103 |
| W-10 | N308568 | N451428-0101 |
| W-10 | N339615 | N451428-0102 |
| W-11 | N158698 | N451428-0102 |
| W-11 | N171840* | N451428-0102 |
| W-11 | N171840** | N451428-0106 |
| W-11 | N346799 | N451428-0104 |
| W-11 | N385847 | N451428-0113 |
| W-20 | N168176 | N451428-0101 |
| W-20 | N172150 | N451428-0104 |
| W-20 | N176466 | N451428-0101 |
| W-20 | N177319 | N451428-0102 |
| W-20 | N250714 | N451428-0105 |
| W-20 | N277158 | N451428-0104 |
| W-20 | N288262 | N451428-0101 |
| W-20 | N297709 | N451428-0106 |
| W-20 | N385815 | N451428-0101 |
| W-20 | N433514 | N451428-0105 |

*For 120 V applications only.
**For 240 V applications only.

| W-800 Transformers | | |
|---|---|---|
| Old Transformer | | W-800 Order Number |
| Type | Number | |
| W-20 | N168176 | N451469-0101 |
| W-20 | N172150 | N451469-0104 |
| W-20 | N176466 | N451469-0101 |
| W-20 | N177319 | N451469-0102 |
| W-20 | N250714 | N451469-0105 |
| W-20 | N277158 | N451469-0104 |
| W-20 | N288262 | N451469-0101 |
| W-20 | N297709 | N451469-0106 |
| W-20 | N385815 | N451469-0101 |
| W-20 | N433514 | N451469-0105 |

# Mini and PT Style Impedance Bonds



*US&S Impedance Bonds*

## Features

- Permits overlay signal currents in DC territories
- High impedance, wide frequency range
- Wide variety of models

## Ordering Information

- Standard order numbers listed on page 3T(3)
- Contact US&S Sales for mounting and cable connection hardware
- Contact US&S Sales for installation parts

## General

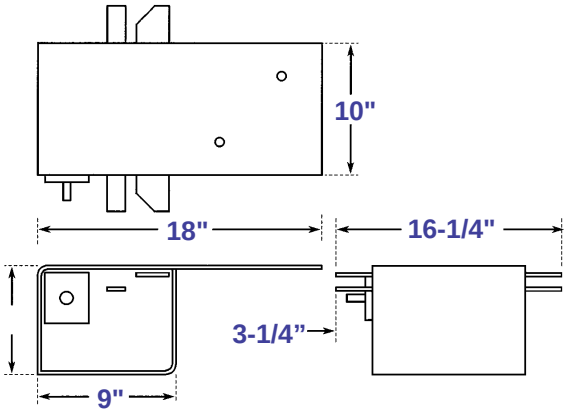
US&S Impedance bonds are designed for electrified territories that use insulated joints to isolate track circuit signalling current from signalling currents of adjacent track circuits, but still permit propulsion current to flow around the joints to or from adjacent track circuits. Bond styles include “Mini” (200 amp/rail AC) and “PT” (1000 to 2500 amp/rail DC).

Typically, impedance bonds are installed in pairs at insulated joint locations. Bond center taps are electrically interconnected with a heavy conductive cable. The remaining two terminals of one bond are connected to the rails with heavy conductive cable (one per rail) on one side of the insulated joints. The remaining two terminals of the other bond are likewise connected on the other side of the insulated joints.

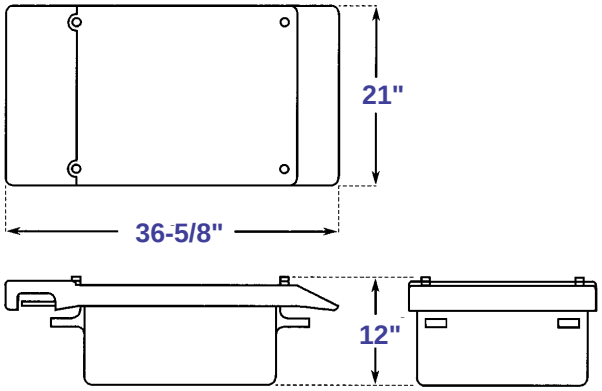
Propulsion currents are divided equally between the two rails and pass through the impedance bond winding such that the propulsion current of the winding halves cancel each other magnetically. As a result, the bond offers very little impedance to the propulsion current flow. AC signalling current flows into the bond from one rail and exits the bond into the other rail. There is no magnetic cancellation and the bond develops an inductive impedance which restricts signalling current flow. This current cannot enter the adjacent track circuits at the center taps connection because there is no suitable return path for the current flow.

US&S impedance bond components are contained in a low profile, heavy cast iron housing designed for mounting between the rails across two adjacent ties. A removable top cover provides routine access. Signal and propulsion current cables are connected, using terminal lugs, to terminal location on either side of the bond housing. “Mini” type impedance bonds are epoxy-encapsulated and selected models incorporate a fabricated steel shell.

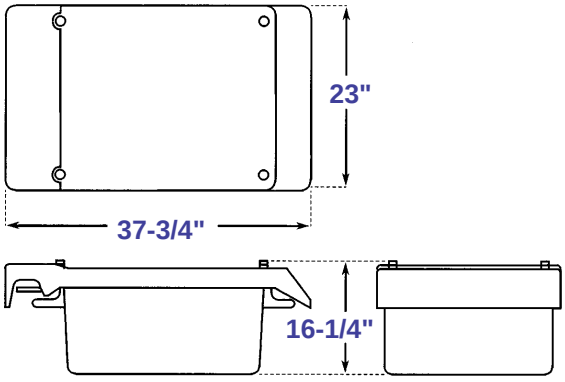
US&S offers a variety of impedance bonds to suit numerous applications. Customized models can be developed as required for unique customer needs. Refer to the ordering tabulation on page 3T(3) for operating specifications.




**“Mini” Impedance Bonds**




**1000 and 1500 Amp Impedance Bonds**




**2500 Amp Impedance Bonds**

| US&S Order Number | Misc. | | | | | | | Rated Ohms of Impedance | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Style | Type | (4) Amps /Rail | DC R-R (Ohms) | Tuned (1) | AFO (3) | WT. (LBS.) | 25 Hz | | 60 Hz | | 100 Hz | | 200 Hz | |
| | | | | | | | | 1V | 5V | 1V | 5V | 1V | 5V | 1V | 5V |
| N451003-0501 | Mini | AC | 300 | 0.00059 | No (2) | -- | 81 | -- | -- | 0.60 | -- | 1.00 | -- | -- | -- |
| N451003-0801 | Mini | AC | 300 | 0.00059 | No | -- | 81 | -- | -- | 0.60 | -- | 1.00 | -- | -- | -- |
| 98065289 | PT | DC | 1000 | 0.00088 | No | Yes | 620 | 0.28 | -- | 0.50 | -- | 1.00 | -- | -- | -- |
| 98065388 | PT | DC | 2500 | 0.00029 | No | Yes | 960 | 0.12 | -- | 0.25 | -- | 0.40 | 0.40 | 0.82 | -- |
| N451003-2501 | PT | DC | 2500 | 0.00030 | Yes | Yes | 960 | -- | -- | -- | -- | -- | 1.60 | -- | -- |
| N451003-2601 | PT | DC | 2500 | 0.00029 | Yes | -- | 1000 | -- | -- | -- | -- | 2.4 | 2.4 | -- | -- |

**Notes**
1. Standard order numbers listed above at right.
2. Equipped with secondary coil, external tuning possible.
3. "Yes" - sufficient impedance exist at typical AFO frequencies to permit typical AFO applications.
4. 2 hr. rating

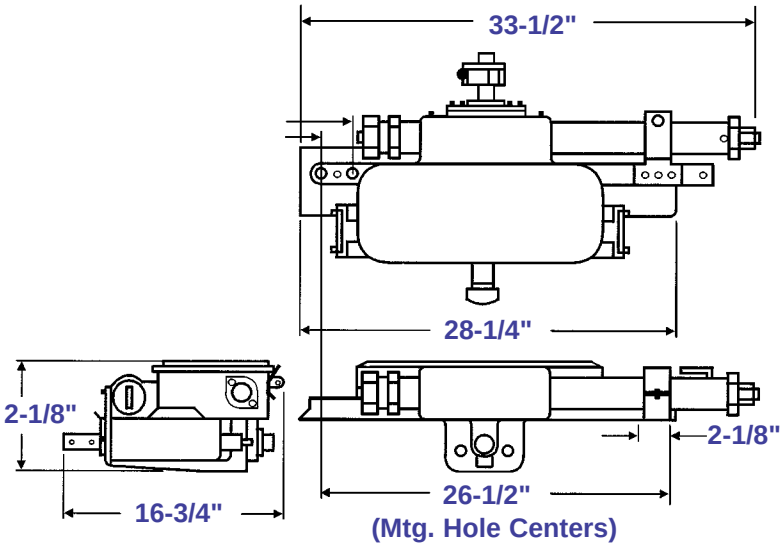
| US&S Order Number | Rated Ohms of Impedance AFO at: | | |
|---|---|---|---|
| | OHM (5) | V | HZ |
| N451003-0501 | -- | -- | -- |
| N451003-0801 | -- | -- | -- |
| 98065289 | 4.75 (Est.) | 4.0 | 525 |
| 98065388 | 2.0 (Est.) | 4.0 | 525 |
| N451003-2501 | 1.0 | 4.0 | 525 |
| N451003-2601 | -- | -- | -- |

* Consult US&S Customer Service or your Sales Representative for all required information.
(5) (Est.) = Estimated value.

UNION SWITCH & SIGNAL

3U(1)
Rev. 5/97

# Style “S” Electro-Pneumatic (EP) Train Stop




## Features

- Provides reliable trip stop action
- Light weight, durable unit

## Service Manual Reference

- Refer to **SM 5434**

## Ordering Information

- Standard order numbers listed in tabulation below
- Models with chain and shaft cover allow tripper arm mounting on either side

US&S’s Style “S” Electro-Pneumatic (EP) Train Stop helps insure that a passing train does not continue moving (if a restrictive cab signal aspect is ignored) by tripping an air release valve on the train. The EP stop is designed for pneumatically operated wayside installations. It employs a helical coil spring for forcing the tripper arm to the stop position. The mechanism drives the tripper arm to the clear position with a minimum of 60 PSI applied air pressure. An air pressure reduction to approximately 30 PSI is sufficient to raise the arm to the full stop position, which helps assure a safe margin for operation. The unit’s outboard bearing is self-aligning to allow for mounting variations and to prevent binding. A coupling in the drive shaft is available with spherical bearing surfaces for centering the drive shaft with the mechanism, and to compensate for any misalignment.

The circuit controller in the EP train stop is driven by a pair of rocker arms actuated by a cam on the drive shaft. Independent contacts in the controller include 3 closed/ 5 open in the clear position. Also, 1 independent normal and reverse contact is provided in each position (stop and clear).

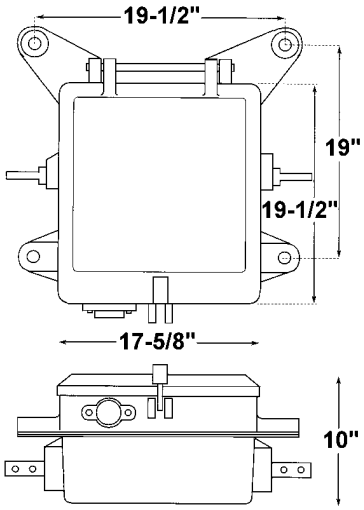
Models of the EP Train Stop are available for left-hand installation only (typical), and with a shaft that allows the tripper arm to be mounted on either side of the unit.

## Specifications

| | | | |
|---|---|---|---|
| ***Operating Air Pressure*** | 60 PSI | ***Stop*** | 30 PSI or less |
| ***Clear*** | 55 PSI or greater | ***Tripper Arm Travel*** | 56 to 60 degrees |

| US&S Order Number | Description |
|---|---|
| N329366 | L.H. unit with conduit port pipe plug |
| N329366-001 | L.H. unit with pipe plug & heater |
| N330549 | L.H. unit with cover chain and shaft cover |

# EM-1 Automatic Train Stop




## Features

- Assured emergency braking for trains
- Right or left-hand layout

## Ordering Information

- Standard EM-1 order numbers listed below
- Please take careful note to equipment characteristics when placing order

## Service Manual Reference

- Refer to **SM 5730**

The EM-1 Automatic Train Stop, which interacts with carborne vehicle control equipment, provides an effective means of activating the train braking mechanism in the event restrictive signals are ignored.

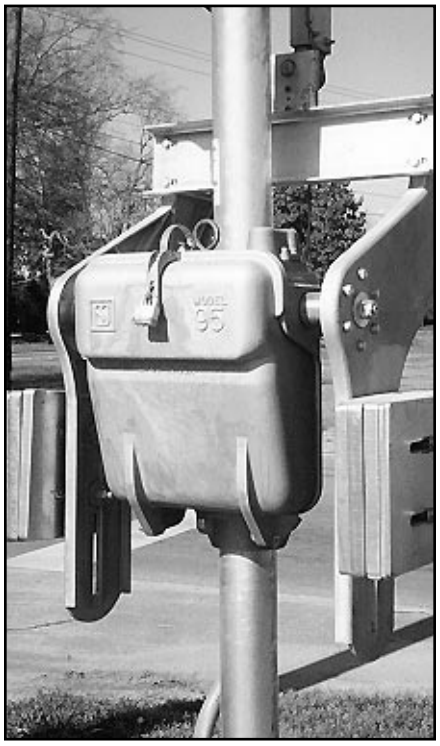
The key component of this unit is a driving trip arm, which is normally pulled, under power, to the clear position 1/2" below top of running rail. If power is interrupted to the unit, a compression spring moves the trip arm back above the rail. With the car carried equipment in a position to react with the EM-1, the trip arm will engage the brake trip air cock on the passing train. Assuming all equipment is functioning properly, this event will initiate a train stopping sequence.

The EM-1 Train Stop is installed on mounting plates midway between the rails or mounted directly on the ties. The rocker shaft may be fastened for either right or left operation, as required.

Spline or universal coupling is available at the rocker shaft connection to the unit. Selected units are equipped with a heater for operation in cold weather areas. Refer to the ordering tabulation for additional design characteristics.

| US&S Order Number | Heater | Frequency (HZ) | Tripper Arm | | Coupling |
|---|---|---|---|---|---|
| | | | Capacitor Set (MFD) | Height Over Rail | |
| N387658-001 | -- | 60 | 20-20 | 2-1/2" - 3" | Spline |
| N387658-004 | -- | 60 | 15-20 | 3-1/2" | Spline |
| N388403 | X | 60 | 20-20 | 2-1/2"- 3" | Universal (R.H.) |

# Model 95 Highway Crossing Gate Mechanism



***Model 95 Gate Mechanism Assembly shown mounted on 5" masts***

## Features

- Reduced size, light-weight design for easy handling
- Compact motor generates more torque than typical gate mechanisms currently in use
- Durable construction for long life
- All parts easy to access/replace
- Circuitry prevents gate from free-falling

## Service Manual Reference

- Refer to **SM 6495**

## Ordering Information

- Order basic Model 95 Gate Mechanism from tabulation on page 4A(3)
- If replacing a non-US&S gate mechanism with a Model 95, gate arm supports must also be ordered
- To order basic mechanisms with custom features, contact your US&S Sales Representative or call 1-800-652-7276

### General

US&S's Model 95 Highway Gate Crossing Mechanism is the new standard for simplicity, reliability, durability, ease of maintenance and value. It is completely reengineered from earlier models, meets or exceeds AAR and other industry standards, and responds to customer requests for a state-of-the-art mechanism built with both safety and value in mind.

### Housing and Gate Arm

The Model 95 features a 1-piece cast aluminum housing and light-weight removable cover (vertically hinged). A heavy duty spring steel hasp on the housing latches the cover to the housing and accepts any standard padlock. Mounting may be done on 4", 5" and 10" masts. Overall, the Model 95 is smaller and about one-third lighter than similar mechanisms. Standard gate arm assemblies are easily fastened and wired to the Model 95 drive shaft. A universal breakaway adapter on the arm joint includes shear pins and a right angle, fall-away hinge to control separation of the arm if it is hit by a motor vehicle. The Model 95 is available with a pedestrian gate arm opposite the highway arm.

### Gearing and Drive Motor

The Model 95 includes a 2-stage, high-strength gear reduction mechanism. Heavy duty damper springs on the main drive shaft prevent any gate arm backlash into the gear train. The Model 95 is driven by a compact but powerful permanent magnet gear motor that generates more torque than larger and heavier motors in use. Stall torque is 2000 ft./lbs., a major improvement over the typical 1300 ft./lbs. rating of other gate mechanisms. Also this motor is capable of moving the gate mechanism off balance with the gate arm missing. If needed, the motor shaft can also be hand cranked via a square shaft extension. The Model 95 also incorporates a simplified hold-clear circuit using an electric brake. This device permits the gate to be locked in the upright position.

### Electrical Controls

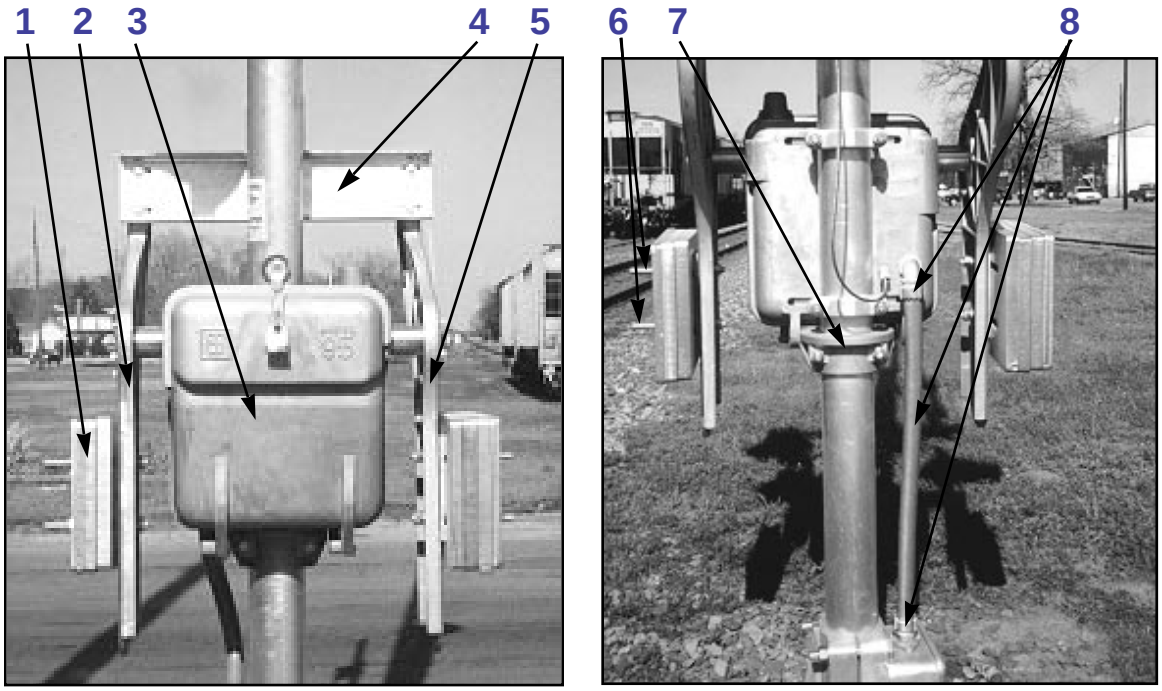
The Model 95 uses a dependable circuit controller that is easily accessed and designed to minimize contact burning. This allows for on-site operation with the gate arm missing. One adjustable resistor allows convenient setting of the arm descent speed.

## Specifications

| | | | |
|---|---|---|---|
| ***Dimensions*** | H= 23"<br>W= 21"<br>D= 13 3/4" | ***Motor Voltage*** | 12 Vdc |
| | | ***Motor Current*** | 15.0 A |
| ***Weight*** | 185 lbs. w/cover<br>160 lbs. w/out cover | ***Motor Stall Torque*** | 2000 ft./lbs. |
| | | ***Motor Relay*** | PN-150HD vital plug-in<br>or<br>Non-Vital |
| ***Mounting*** | 4", 5" & 10" pipe masts<br>Eyebolt for lifting | | |

# *Model 95 Gate Mechanism & Assembly Components*

The diagram below depicts some of the major components used in a Model 95 installation. Cross-reference the item number with the description below to help identify what parts you may need for a particular installation. Ordering numbers can be found on pages 4A(3) and 4A(4).




1. Counterweights
2. Left Hand Gate Arm Support
3. Model 95 Gate Mechanism
4. Gate Arm Adapter
5. Right Hand Gate Arm Support
6. Stud Plate Assembly
7. (Optional) Pivot Clamp
8. Conduit Kit

| Model 95 Gate Mechanisms and Assemblies for Highway Crossings | |
|---|---|
| US&S Order Number | Description |
| N467801-01 | Model 95 Mechanism w/ Non-Vital Relay (Mechanism only) |
| N467802-01 | Model 95 Mechanism w/ Vital Relay (Mechanism only) |
| X467402-01* | Model 95 Mechanism & Assembly w/ Non-Vital Relay |
| X467402-02* | Model 95 Mechanism & Assembly w/ Vital Relay |
| *Assembly includes; LH & RH Gate Arm Supports, Gate Arm Adapter, Conduit Kit and Stud Plates. | |

| Model 95 Pedestrian Gate Mechanisms ( Highway and Sidewalk Crossings in Same Unit) | |
|---|---|
| US&S Order Number | Description |
| N467804-01 | Model 95 Mechanism w/ Vital Relay (Highway & Sidewalk Crossing in same unit) |
| N467803-01 | Model 95 Mechanism w/ Non-Vital Relay (Highway & Sidewalk Crossing in same unit) |

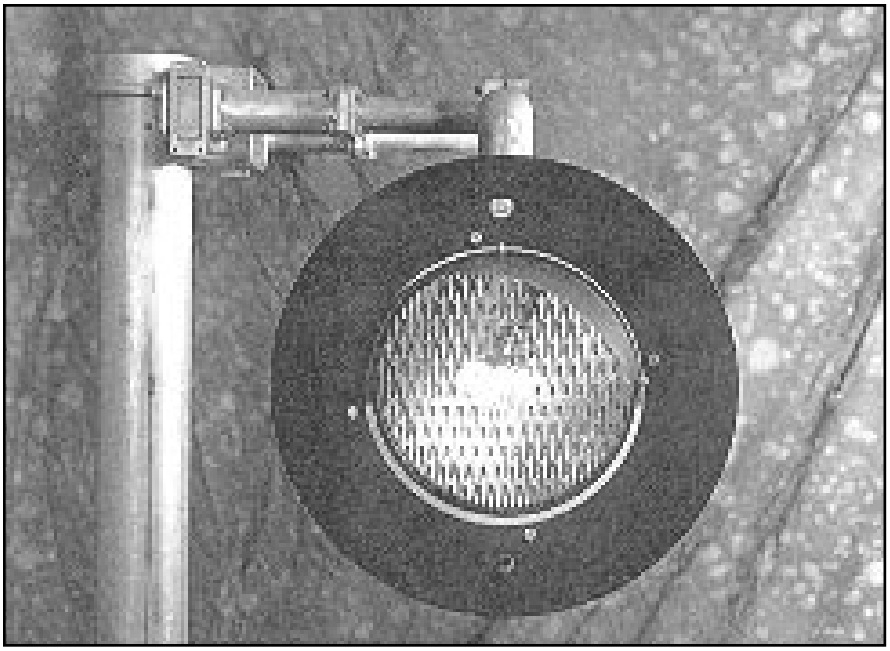
| Model 95 Sidewalk Gate Mechanisms | |
|---|---|
| US&S Order Number | Description |
| N467801-03 | Model 95 Mechanism Sidewalk Crossing Gate (Gate mounted on right side of mechanism) |
| N467801-04 | Model 95 Mechanism Sidewalk Crossing Gate (Gate mounted on left side of mechanism) |

| Model 95 Gate Mechanism Assembly Components, Optional Pivot Clamp & Torque Wrench Tool Kit | |
|---|---|
| US&S Order Number | Description |
| J705191-5806 | Gate Arm Adapter |
| N467301-01 | Left Hand Gate Arm Support with Hubs |
| N467302-01 | Right Hand Gate Arm Support with Hubs |
| X467000-01 | Stud Plate for Counterweight Mounting |
| X467000-02 | Conduit Kit |
| X467054-02 | (Optional) Pivot Clamp |
| X467000-03 | Model 95 Torque Wrench Kit |

| Model 95 Gate Mechanism Heater Kits | |
|---|---|
| US&S Order Number | Description |
| N467048-01 | Model 95 Heater Kit (120V) |
| N467048-02 | Model 95 Heater Kit (24V) |
| N467048-03 | Model 95 Heater Kit (240V) |

| Model 95 Gate Mechanism Counterweight Kits, Individual Counterweights & Extension Arm | |
|---|---|
| US&S Order Number | Description |
| X467401-01 | Counterweight Kit for 12-15' Arm |
| X467401-02 | Counterweight Kit for 16-18' Arm |
| X467401-03 | Counterweight Kit for 19-21' Arm |
| X467401-04 | Counterweight Kit for 22-23' Arm |
| X467401-05 | Counterweight Kit for 24-26' Arm |
| X467401-06 | Counterweight Kit for 27-29' Arm |
| X467401-07 | Counterweight Kit for 30-32' Arm |
| X467401-08 | Counterweight Kit for 33-36' Arm |
| X467401-09 | Counterweight Kit for 37-40' Arm |
| M451484-3111 | 29 lb. Counterweight (Individual) |
| M451484-3112 | 72 lb. Counterweight (Individual) |
| N451484-2403 | Counterweight Extension Arm (Required for Gate Arms that exceed 38' in length) |
| X467000-01 | Stud Plate for Counterweight Mounting |

# HC-120B Highway Crossing Flashing Light Unit



*HC-120B Highway Crossing Flashing Light Unit*

## General

The HC-120B light unit's reflector and lens are high-precision components designed to produce an exceptionally bright image from a low wattage bulb. Reflector-to-bulb focusing is set at the factory with a rigid 3-point mounting system. Lens replacement does not alter factory alignment. No refocusing is necessary at lamp replacement time.

Wiring of the HC-120B light unit is simple. Clear access for wiring is provided through the threaded crossarm mounting fitting. Standard AAR terminals serve as quick connect/disconnect points. Attachment of the optional hood and background is simplified with the use of the standard hex-head bolts. Three versions of the HC-120B red lens provide a variety of different deflection angles to suit the needs of many different possible installation sites and railroad requirements. Pointing alignment is performed with a convenient optical site at the bottom of the reflector housing (visible through background).

## Specifications

| | |
|---|---|
| ***Dimensions*** | Diameter= 12"  Depth= 7" |
| ***Lamp*** | SC bayonet base |
| ***Lens Deflections*** | See ordering tab page 4B(2) |
| ***Backgrounds*** | 20" or 24" |
| ***Hood*** | 10.5" |

## Features

- Brilliant aspect from a simple, low cost unit
- Easy to mount, wire and aim
- No lamp refocusing required
- Numerous spread lens options

## Ordering Information

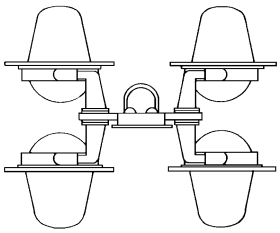
- Order basic light units and replacement hoods/backgrounds from list on next page
- See " Highway Crossing Support Equipment" section for detailed information in ordering complete flashing light assembly with junction box and crossarm
- To order highway crossing assemblies contact your US&S Sales Representative or call 1-800-652-7276
- See following pages for lamp ordering numbers

| HC-120B Flashing Light Units | | | |
|---|---|---|---|
| US&S Order Number | Spread Lens | Background | Hood |
| N451497-0601 | 20 degrees/ 32 degrees | None | None |
| N451497-0602 | 30 degrees/ 15 degrees | None | None |
| N451497-0603 | 70 degrees/ 0 degrees | None | None |
| X451497-0604 | 20 degrees/ 32 degrees | 20" | Included |
| X451497-0605 | 30 degrees/ 15 degrees | 20" | Included |
| X451497-0606 | 70 degrees/ 0 degrees | 20" | Included |
| X451497-0607 | 20 degrees/ 32 degrees | 24" | Included |
| X451497-0608 | 30 degrees/ 15 degrees | 24" | Included |
| X451497-0609 | 70 degrees/ 0 degrees | 24" | Included |

| HC-120B Flashing Light Assemblies | | | | |
|---|---|---|---|---|
| US&S Order Number | Description | | | |
| | Mast | Type | Spread | Reference Figure |
| X451506-0103 | 4" | 1-Way | 30 degrees/ 15 degrees | Figure “B” Below |
| X451506-0104 | 4" | 2-Way | 30 degrees/ 15 degrees | Figure “A” Below |
| X451506-0303 | 5" | 1-Way | 30 degrees/ 15 degrees | Figure “B” Below |
| X451506-0306 | 5" | 2-Way | 30 degrees/ 15 degrees | Figure “A” Below |
| X451506-0308* | 5" | 2-Way | 30 degrees/ 15 degrees | Figure “C” Below |
| X451506-0312* | 5" | 2-Way | 30 deg./ 15 deg. & 70 deg./ 0 deg. | Figure “C” Below |
| X451506-0313 | 5" | 1-Way | 70 degrees/ 0 degrees | Figure “B” Below |
| X451506-0314* | 5" | 2-Way | 70 degrees/ 0 degrees | Figure “C” Below |

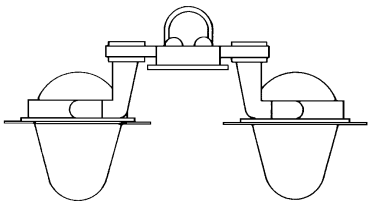
* Asterik indicates that assembly includes hardware for 10" rear extension.

**Figure “A”**



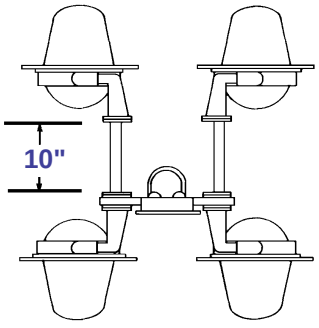
**2-Way Back-to-Back Flashing Light**

**Figure “B”**



**1-Way Flashing Light**

**Figure “C”**




**2-Way Back-to-Back Flashing Light for Use with Gate Arm Assemblies**

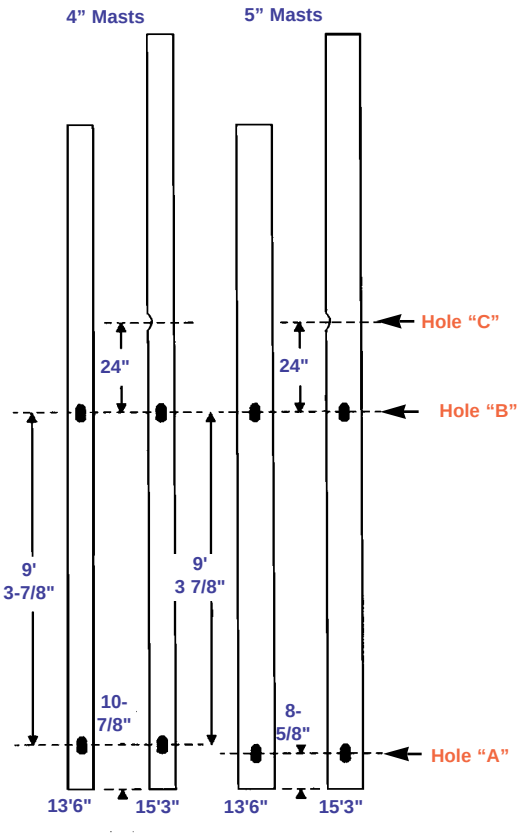
| Replacement Hoods and Backgrounds | |
|---|---|
| US&S Order Number | Description |
| M451498-2501 | 10.5” Hood |
| M451498-3701 | 20" Background |
| M451498-3702 | 24" Background |

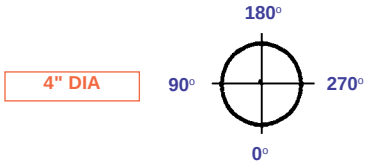
| Highway Crossing Lamps | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| US&S Order Number | AAR Item # | Volts | Amp/Watt CP | Bulb Style | LCL | Base | Filament(s) Types | Life Hours |
| J071463 | 88 | 10 | 18W | S-11 | 1-1/4 | SCBC | CC-6 | 1000 |
| J071574 | 100 | 10 | 25W | S-11 | 1-1/4 | SCBC | CC-6 | 1000 |
| J714283 | 104 | 10 | 16W | Q1 | 1-1/4 | SC | C-6 | 2500 |
| J714284 | -- | 10 | 36W | Q1 | -- | SC | -- | -- |
| J714054 | 35 | 125 | 25W | G 16-1/2 | 1-1/4 | SC | C-5 | 1000 |

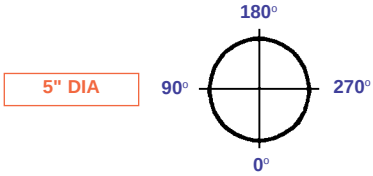
# Highway Crossing Support Equipment

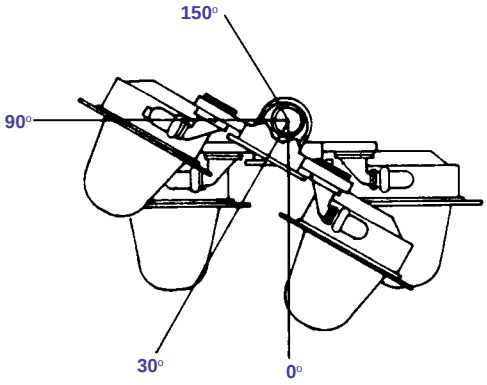
This catalog section provides basic ordering information for key components of US&S's grade crossing signal assemblies. Included are popular order numbers for all components used in complete assemblies. Contact US&S Sales to order any types or models of crossing components that do not appear in the following sections

## *Masts*



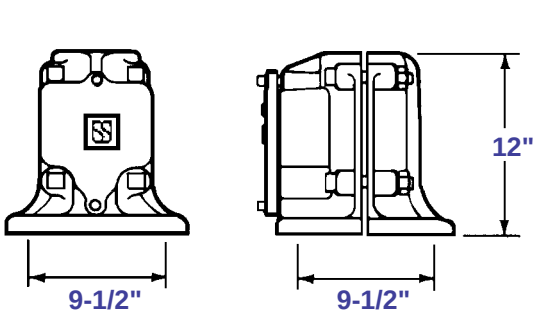



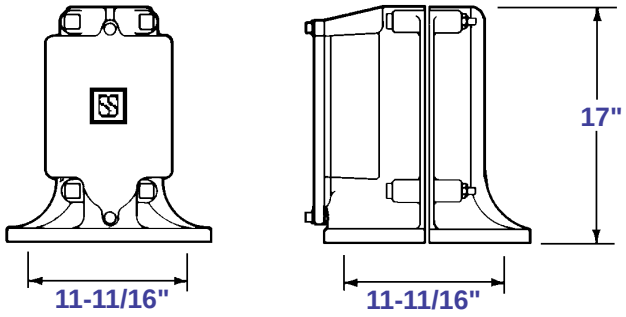

| US&S Order Number | Description | | | Hole A J.B. Base | Hole B J.B. Crossarm | Hole C Convergence |
|---|---|---|---|---|---|---|
| | Application | Diameter | Ht. | | | |
| M451394-5101 | Standard | 4" | 13'-6" | 0° | 0° | -- |
| M451394-5103 | Standard | 4" | 15'-3" | 0° | 0° | -- |
| M451394-3902 | Standard | 5" | 13'-6" | 0° | 0° | -- |
| M451394-4001 | Standard | 5" | 15'-3" | 0° | 0° | -- |
| M451394-4002 | Converging | 5" | 15'-3" | 0° | 0° | 30° |
| M451394-5501* | Standard | 5" | 15'-3" | 0°/180° | 0° | -- |
| M4513944201 | Standard | 5" | 6' 9" | 0° | -- | -- |

To order masts with customized drilling, contact your US&S Sales Representative and supply them with a) the required mast length, b) the required diameter, c) and the angle and direction (CW or CCW from the 0 degree reference point) of the second cross arm hole (refer to the above diagram).
* To use with split junction box J705049-0901.

# Masts - Junction Box Bases




Base for 4" Mast

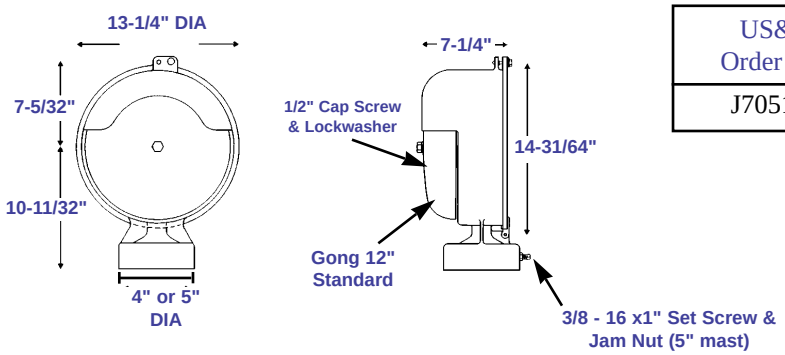



Base for 5" Mast

| US&S Order Number | Description | | |
|---|---|---|---|
| | Type | Mast | Bolt Spacing |
| 79685041 | Single | 4" | 9-1/2" x 9-1/2" |
| J705049-0801 | Single | 5" | 11-11/16" x 11-11/16" |
| J705049-0901* | Double | 5" | 11-11/16" x 11-11/16" |

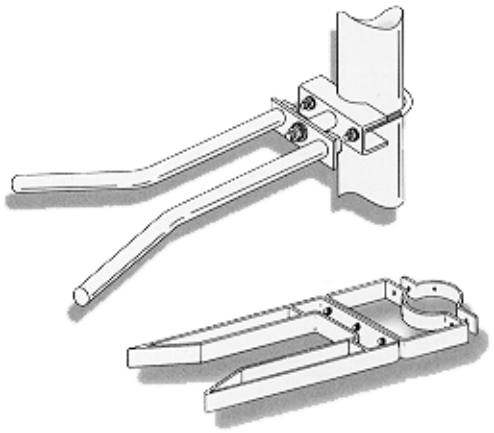
* Double junction box not shown in diagrams above

# Crossing Bell



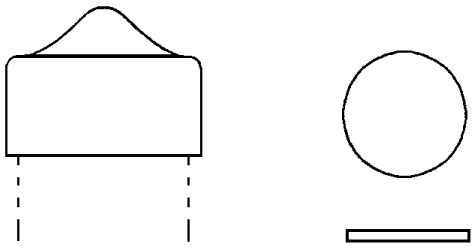

| US&S Order No. | Description |
|---|---|
| J705173 | Crossing Bell for 4" or 5" mast |

## *Wind Guards*



| US&S Order Number | Description |
|---|---|
| J705191-5820 | High Wind Bracket (Rigid) |
| J705191-5822 | High Wind Bracket (Flexible) |

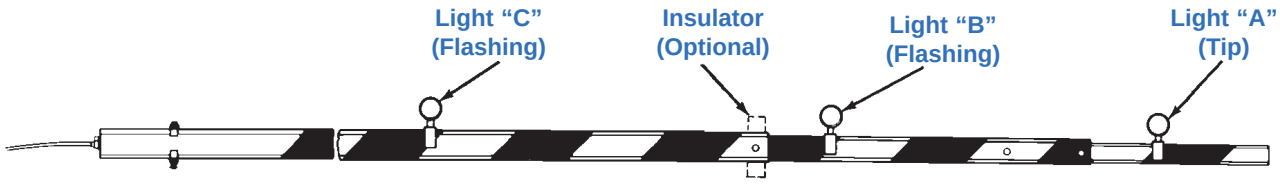
## *Mast Pinnacles & Rodent Covers*



| US&S Order Number | Description |
|---|---|
| J026104 | Pinnacle - 4" mast |
| J026111 | Pinnacle - 5" mast |
| M451195-3601 | Rodent cover - 4" mast |
| M451195-3602 | Rodent cover - 5" mast |

# *Highway Crossing Gate Arms*

Complementing US&S's Model 95 Gate Mechanism is a cost-effective line of highway crossing gate arms. Arms are available in adjustable lengths from 12 to 40 feet with a choice of aluminum/ fiberglass or fiberglass construction. All arms incorporate shear pins to minimize vehicle impact damage. Red/white diagonal striping draws attention to the arm when it is deployed, even in poor weather or at night. Striping is available in Engineering and High Intensity grades; grades which meet all industry standards. Arm visibility may be enhanced with 4" or 7" dual-direction lights. Light unit wiring can be fully plug-connected for easy replacement. You can select your desired gate arm configuration from the preconfigured gate arm option list below, or contact your US&S Sales Representative or a US&S Customer Service Representative at 1-800-652-7276 to order complete arm assemblies per your specifications. Please contact Customer Service Department to order lengths that exceed 40'.




| US&S Order Number | Type | Length | Sheeting | Lights |
|---|---|---|---|---|
| J705191-8001 | Aluminum/ Glass | 12' - 18' | Eng. Grade | 4" |
| J705191-8002 | Aluminum/ Glass | 12' - 18' | Hi Intensity | 4" |
| J705191-8003 | Aluminum/ Glass | 12' - 18' | Eng. Grade | 7" |
| J705191-8004 | Aluminum/ Glass | 12' - 18' | Hi Intensity | 7" |
| J705191-8005 | Aluminum/ Glass | 19' - 32' | Eng. Grade | 4" |
| J705191-8006 | Aluminum/ Glass | 19' - 32' | Hi Intensity | 4" |
| J705191-8007 | Aluminum/ Glass | 19' - 32' | Eng. Grade | 7" |
| J705191-8008 | Aluminum/ Glass | 19' - 32' | Hi Intensity | 7" |
| J705191-8009 | Aluminum/ Glass | 33' - 40' | Eng. Grade | 4" |
| J705191-8010 | Aluminum/ Glass | 33' - 40' | Hi Intensity | 4" |
| J705191-8011 | Aluminum/ Glass | 33' - 40' | Eng. Grade | 7" |
| J705191-8012 | Aluminum/ Glass | 33' - 40' | Hi Intensity | 7" |
| J705191-8013 | Fiberglass | 12' - 18' | Eng. Grade | 4" |
| J705191-8014 | Fiberglass | 12' - 18' | Hi Intensity | 4" |
| J705191-8015 | Fiberglass | 12' - 18' | Eng. Grade | 7" |
| J705191-8016 | Fiberglass | 12' - 18' | Hi Intensity | 7" |
| J705191-8017 | Fiberglass | 19' - 28' | Eng. Grade | 4" |
| J705191-8018 | Fiberglass | 19' - 28' | Hi Intensity | 4" |
| J705191-8019 | Fiberglass | 19' - 28' | Eng. Grade | 7" |
| J705191-8020 | Fiberglass | 19' - 28' | Hi Intensity | 7" |

**GATE ARM ORDERING OPTIONS**

- Construction: Aluminum/ Fiberglass* or Fiberglass
- Length: 12' to 40'
- Sheeting: Engineering Grade or High Intensity
- Lights: 4" or 7"
- Cord Sets: Coil Cord or Standard
- Wiring: Plug-Connected or Hard-Wired

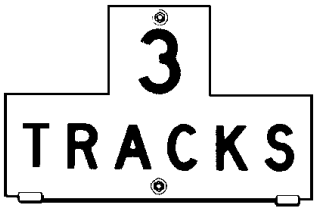
* Aluminum encased in fiberglass. Recommended for installations with exposed power sources (e.g. transit third rail)

# Highway Crossing Gate Arms Conversion Bracket

| US&S Order Number | Description |
|---|---|
| J792905 | Adapts US&S gate arm to other supplier's gate mechanisms or other supplier's gate arms to US&S gate mechanisms |

* Contact US&S Sales for specific conversion options available

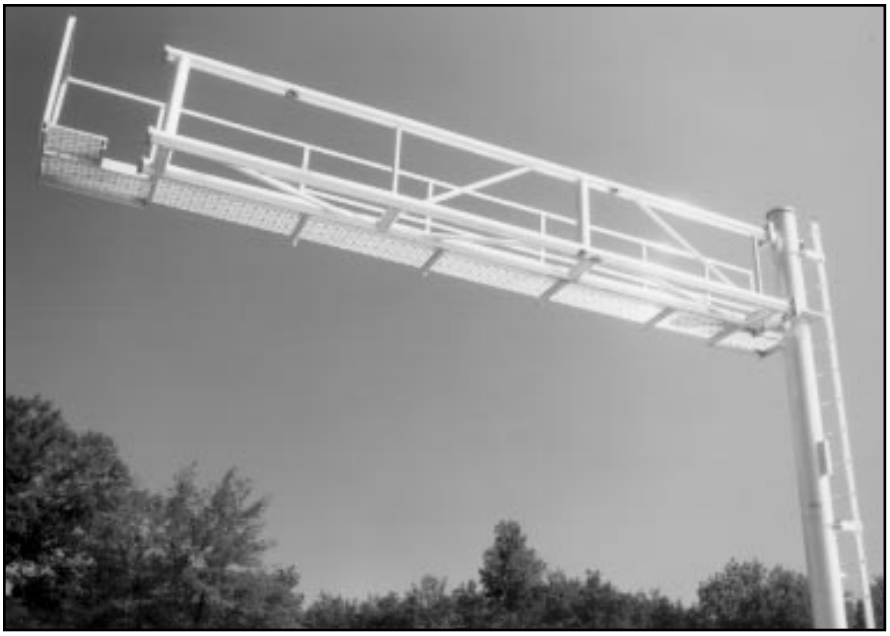
# Signs



| US&S Order Number | Description | | | | |
|---|---|---|---|---|---|
| | Type | Reflective Material | | Mast Diameter | Notes |
| | | Eng. Grade | Hi Intensity | | |
| X392931-001 | "RAILROAD CROSSING" | X | -- | 4" | -- |
| X392931-007 | "RAILROAD CROSSING" | -- | X | 4" | -- |
| X392931-002 | "RAILROAD CROSSING" | X | -- | 5" | -- |
| X392931-008 | "RAILROAD CROSSING" | -- | X | 5" | -- |
| X392930-001 | "STOP ON RED" | X | -- | 4" | -- |
| X392930-005 | "STOP ON RED" | -- | X | 4" | -- |
| X438077 | "STOP ON RED" | X | -- | 5" | 1 |
| J791615 | "2-TRACK" | X | -- | -- | 2 |
| J791615-0007 | "2-TRACK" | -- | X | -- | 2 |
| J791615-0001 | "3-TRACK" | X | -- | -- | 2 |
| J791615-0008 | "3-TRACK" | -- | X | -- | 2 |

NOTES 1 With stand-off mast mount.
2 Mounting Hardware must be ordered separately with "TRACK" signs: order X392929-001 for mounting to 4" mast, X392929-002 for 5" mast, X392929-004 for 10" mast. Order N437997 for 4" and 5" mast "TRACK" sign extension.

# Highway Crossing Cantilever Assemblies



## Features

- Easy installation of crossing apparatus
- Designed for user convenience, safety and security

## Ordering Information

- Order basic cantilever assemblies (without signals, signs, etc.) from tabulation below and equipment to compliment the mast from the "Highway Crossing Support Equipment" section of this manual
- For special ordering requirements, contact your US&S Sales Representative or call 1-800-652-7276

## General

The US&S highway crossing cantilever assemblies offer superior strength and stability with minimum weight. Features include:

- Welded aluminum construction with 12 to 40 foot arms in 2' increments
- 4-anchor bolt foundation for single or dual mast (10" or 12")
- Conveniently placed ladder and walkway for flashing signal

The 18-inch wide service walkway includes a 3-foot railing, non-skid surface and grill construction to prevent rain water or snow from building up. An anti-climb guard on the ladder inhibits unauthorized access to the walkway.

US&S's cantilevers are made of rugged 6061-T aluminum alloy, while all the fastening hardware uses corrosive resistant stainless steel. An assembly can bear sustained winds of up to 100 mph and gusts up to 130 mph. Up to a 500 lb. load can be carried at the end of the walkway with minimal overall deflection. The complete arm structure is assembled at the factory, thus minimizing field assembly work.

### Single, 10" Masts

| US&S Order Number | Arm |
|---|---|
| X451902-0112 | 12' |
| X451902-0114 | 14' |
| X451902-0116 | 16' |
| X451902-0118 | 18' |
| X451902-0120 | 20' |

### Dual, 10" Masts

| US&S Order Number | Arm |
|---|---|
| X451902-0326 | 26' |
| X451902-0328 | 28' |
| X451902-0330 | 30' |
| X451902-0332 | 32' |
| X451902-0334 | 34' |
| X451902-0336 | 36' |
| X451902-0338 | 38' |
| X451902-0340 | 40' |

### Single, 12" Masts

| US&S Order Number | Arm |
|---|---|
| X451902-0222 | 22' |
| X451902-0224 | 24' |

# HX-1 Highway Crossing Power Pack

## Features

- Normal and standby power output
- Services up to four Style C track circuits

## Ordering Information

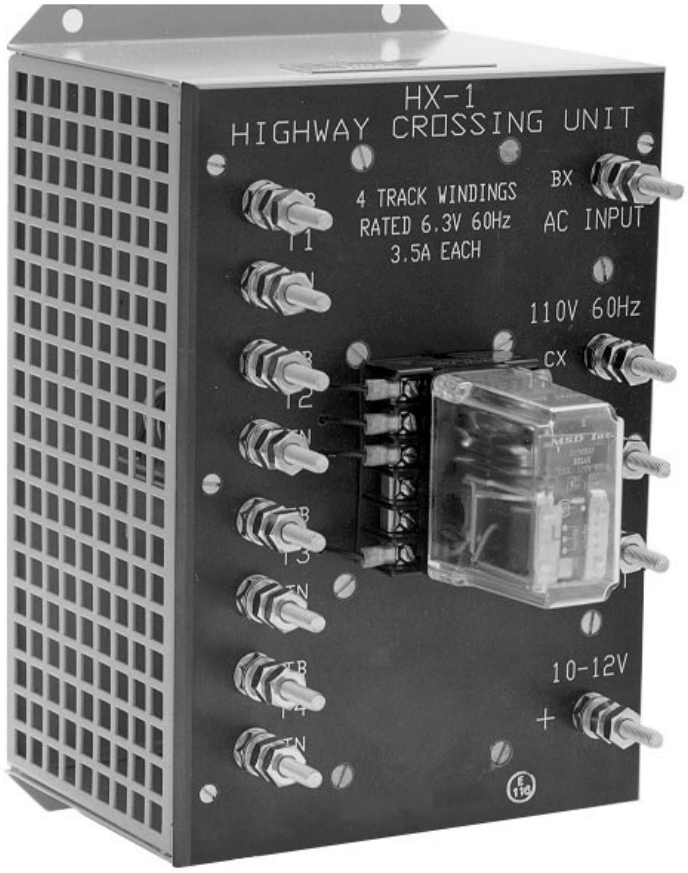
- Standard order numbers for HX-1 Power Pack, unit key components and ST-3 rectifier listed below

| US&S Order No. | Description |
|---|---|
| 98605009 | HX-1 Power Pack, complete |
| 98805077 | ST-3 Rectifier |
| N393794 | RC-1 Rectifier |
| 25530429 | Inverter transformer* |
| 87015378 | Power transfer relay* |
| 34525001 | Power transistor* |

*HX-1 Key Replacement Parts

## Specifications

| | |
|---|---|
| ***Input Voltage*** | 110 Vac and 10-12 Vdc, 110 VA |
| ***Secondaries*** | 6.3 V, 3.5 A, 100 VA rating |
| ***Inverter Output*** | 110 Vac |
| ***Unit Weight*** | 19 lbs. |



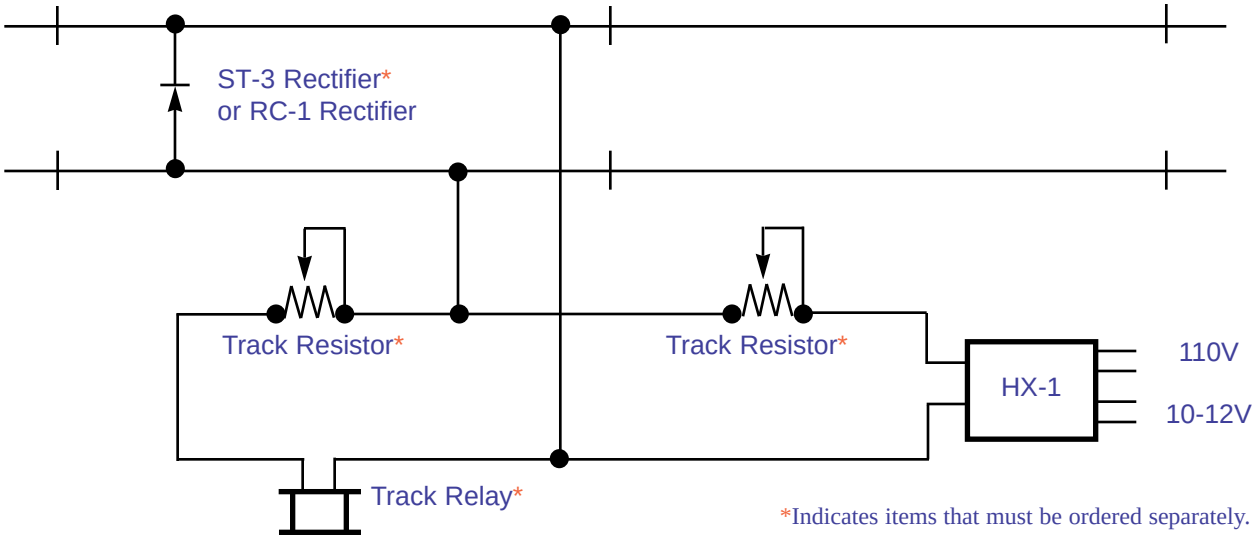

## General

The HX-1 Power Pack provides power for up to four AC-DC (style “C”) track circuits, which are typically used in non-signaled and industrial railroads. The unit is particularly useful at installations with poor rail shuntings. A typical application is illustrated on page 4E(2).

The HX-1 package consists of a solid state DC to AC inverter, and output transformer with four secondaries and a power transfer relay.

Under normal conditions, the unit is fed by 110V/60 Hz power. This voltage is stepped down to 6.3 volts at each of the four secondaries. In the event that AC power fails, the incorporated power transfer relay de-energizes automatically, allowing the unit to operate with a 10-12 Vdc power source. The incorporated solid state inverter converts the DC energy to AC, which operates the unit. No adjustments are necessary.

Components of the HX-1 are contained and connected in a single unit. AAR terminals are provided for all external connections.




*Indicates items that must be ordered separately.

# Electric Switch Machines

## Features

- Rugged design, outstanding service record
- Remote or on-site control
- Wide selection of operating speeds and voltages
- Right or left-hand layout
- Meets all AAR standards
- New low-profile M-3 for tight clearances

## Service Manual Reference

- Refer to **SM 6263** for standard M-3, M-23A and M-23B parts lists
- Refer to **SM 6444** for Low Profile M-3 parts lists.

## General

US&S's style "M" Electric Switch Machines are rugged and reliable units designed for any installation where electric power is available. The M-23A and M-23B units have dual control features, including a hand-throw lever to permit operation by on-site trainmen or maintainers, as well as by remote controlled power.

The standard M-3 Switch Machine is recommended for applications where there is seldom a need to manually operate the switch. These three machines are available with a variety of operating speeds and motor voltages.

For installations where extra vehicle clearance is needed, the Low Profile M-3 Electric Switch Machine is available. *This machine is similar to the standard M-3 in design and operation, but is 5/8 inches lower vertically.* This small but important height reduction makes the Low Profile M-3 ideal for third rail transit applications where additional clearance is needed for the vehicle pick-up shoe. The point detector bar can be vertically lifted from the machine, allowing easy removal in tight clearances. Left and right-hand versions of these machines are available, each with a single operating voltage, gear ratio, and wire control scheme.

Style "M" Electric Switch Machines consist of a motor, gear train, cam arrangement (for operating the switch and locking), and a circuit controller with a point detector (with latch device). A latchout retrofit kit is available for the point detector mechanism (see ordering tabulation). Components in this kit enable the circuit controller indication contacts to be held open (until reset) when the point detector bar is displaced while the machine is in the locked position.

The M-23A and M-23B machines require a somewhat higher clearance than the standard low Profile M-3's. Both models of the M-3 Switch Machine can be operated by hand by inserting a temporary crank.The M-23A uses a different hand throw pinion than the M-23B, which affects hand throw locking.

Power operation is the same with both machines. In the M-23A, the hand throw lever gives the same mechanism stroke and full lock rod protection as the power operated mode. In the M-23B, however, the lever does not provide lock rod protection (slide bar and lock box do not move full stroke). All four machines are wired at the factory with internal wiring connected to a main ter-

minal board in the motor compartment.

A typical wiring diagram or working drawing is enclosed with each shipped machine to show how external connections should be made to the main terminal board for a particular application.

***Circuit Controller***

The Circuit Controller used in the style "M" switch machines has four pairs of contacts set as normal, regardless of which end of the operating stroke is designated as normal.

***Motor and Gear Train***

The "M" Electric Switch Machines use a fully enclosed, permanent magnet motor. This type of motor provides lower inductance, better EMI immunity and higher efficiency than previous wound field motors, and incorporates simpler 3-wire control. Permanent magnet motors are also available for retrofitting older models of these switch machines; refer to ordering tables. Certain styles of wound field motors are still available.

Each of the M-3, M-23A, and M-23B Switch Machines are comprised of a pinion on the end of the motor shaft, one or two reduction gears, clutch gear, friction clutch, worm shaft and worm gear. Three different gear ratios are used to provide three operating speeds. The Low Profile M-3 incorporates the same basic gear train concept as the other style "M" machines, and is provided with a single gear ratio of 189:1

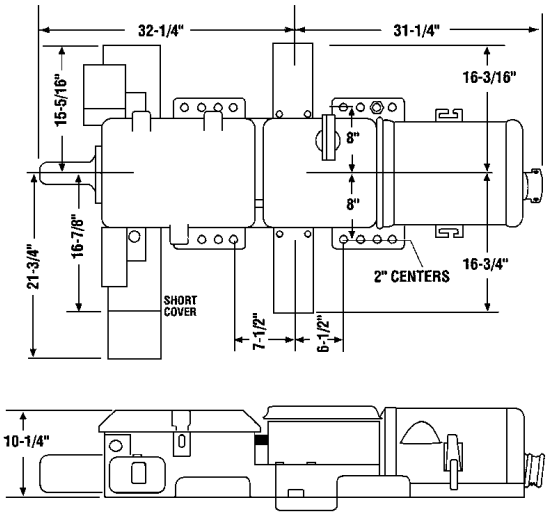
In all style "M" machines, a friction clutch protects the mechanism from the shock incurred at the end of a stroke, or when an obstruction is present. For complete motor and gear train specifications, refer to the ordering tables on pages 5A(4) and 5A(5).

## Specifications

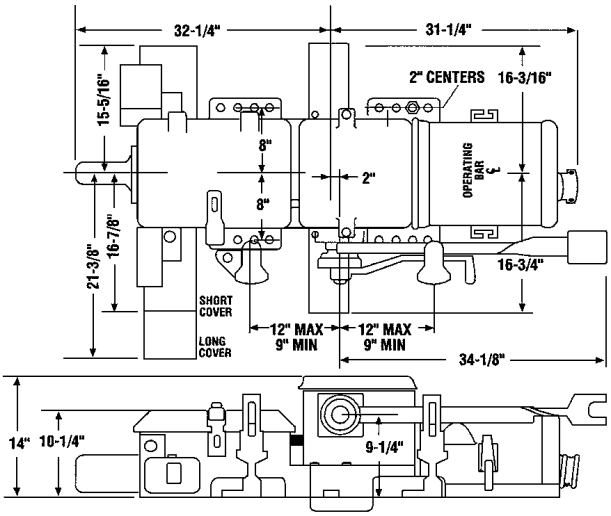
| | |
|---|---|
| ***Weight*** | *Standard M-3, Low Profile M-3:* 810 lbs.<br>*M-23A & M-23B:* 860 lbs. |
| ***Motor Type*** | Various permanent magnet and field wound |
| ***Motor Voltage*** | *Standard M-3, M-23A, M-23B:* See ordering tables<br>*Low Profile M-3:* 110 Vdc |
| ***Motor RPM*** | *Standard M-3, M-23A, M-23B:* 500 RPM for 528:1 gear machines, 1450 RPM for 189:1 machines, 650 RPM for 360:1 gear machines |
| ***Operating Time*** | *Standard M-3, M-23A, M-23B:* See ordering table<br>Low Profile M-3: 4.5 seconds |
| ***Clutch Setting*** | *Standard M-3:* 14A for 189:1 gear machines, 12A for 528:1 gear machines<br>*Low Profile M-3:* 13A<br>*M-23A, M-23B:* 14A for 189:1 gear machines, 23A for 360:1 gear machines, 12A for 528:1 machines |

## Ordering Information

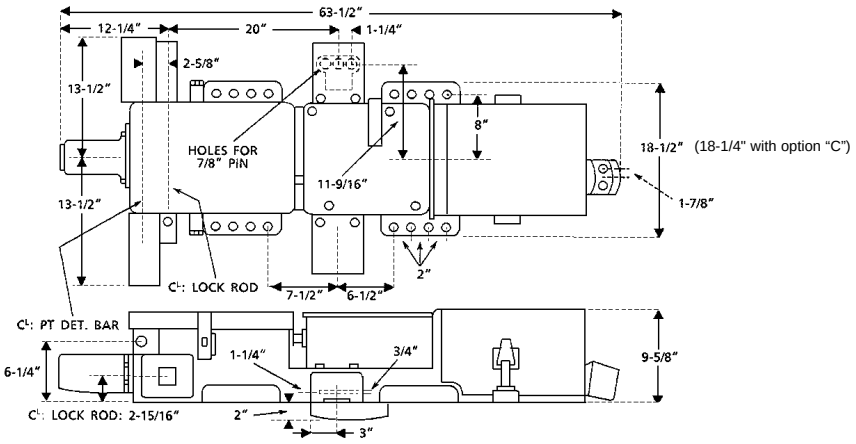
- Style "M" Electric Switch Machines listed on pages 5A(4) and 5A(5)
- To order standard M-3, M-23A or M-23B switch machine:
  1. Refer to "Configuration Guide" in chart on next page. Guide gives all available design and operating options, each denoted with a letter.
  2. Go to ordering tabulation and select machine with desired options
  3. Also select machine according to desired motor voltage, operating speed and gear ratio.
- To order a Low Profile M-3 switch machine, refer to the separate table for that machine.
- Permanent magnet retrofit motor kits for old style M-3, M-23A and M-23B machines listed on page 5A(5).
- Point detector bars, lock rods and lock connecting rods ordered separately. Refer to page 5K(2).
- Order retrofit motor kits according to motor voltage and gear ratio of existing machines.
- Latchout retrofit kit for all machines listed on page 5A(5).
- If ordering style "M" machines for a new switch layout, please supply all required specifications and mounting dimensions.




Standard M-3




M-23 A/B




Low Profile

## Configuration Ordering Guide: Standard M-3, M23-A, and M-23B (Not applicable to Low Profile M-3)

| Ref. | Options | Ref. | Options |
|---|---|---|---|
| A | One 15W heater in circuit controller | J | Two 15W, 24V heaters. One in controller, one in motor |
| B | Two 15W 115V heaters. One controller, one in motor | K | Flag type terminals |
| C | Machined mounting lugs | L | No drain plugs in crankcase cover |
| D | Two 15W, 115/230V heaters. One in controller, one in motor | M | No latch for manual reset |
| | | N | 5-wire control |
| E | Clutch set to 14 amps | O | 3-wire control |
| F | Terminal board in junction box | P | Telephone jack in circuit controller compartment |
| G | Circuit controller without point detector latch | Q | Thermostat in motor compartment |
| H | Ventilators in circuit controller department | R | Switch for heater |
| I | Two 15W, 230V heaters: one in controller, one in motor | S | Lock rod openings closed |

## Standard M-3 Electric Switch Machine

| US&S Order Number | Description | | | | | |
|---|---|---|---|---|---|---|
| | Layout | Old Machine* | Motor (VDC) | Speed (Sec.) | Gear Ratio | Options Ref.** |
| N451160-0306 | L.H. | N437914-0001 | 110 | 4.5 | 189:1 | B, C, N |
| N451160-0308 | L.H. | N438500-0001 | 110 | 4.5 | 189:1 | B, O |
| N451160-0311 | L.H. | N43587-0001 | 110 | 4.5 | 189:1 | B, C, O |
| N451160-0303 | R.H. | N345101 | 110 | 4.5 | 189:1 | A, K, N |
| N451160-0305 | R.H. | N437914 | 110 | 4.5 | 189:1 | B, C, N |
| N451160-0307 | R.H. | N438500 | 110 | 4.5 | 189:1 | B, O |

*For reference only **Refer to Configuration Guide on previous page

## Low Profile M-3 Electric Switch Machine

| US&S Order Number | Description* | | | | | | |
|---|---|---|---|---|---|---|---|
| | Layout | Motor (VDC) | Speed (Sec.) | Gear Ratio | Control | Clutch Setting | Pt. Det. Latch |
| N451160-1401 | L.H. | 110 | 4.5 | 189:1 | 3-Wire | 13A | X |
| N451160-1501 | R.H. | 110 | 4.5 | 189:1 | 3-Wire | 13A | X |

*Machines equipped with circuit controller and motor compartment heaters.
Contact US&S Sales or request Service Manual 6444 for additional information

## M-23A Electric Switch Machine

| US&S Order Number | Description | | | | | |
|---|---|---|---|---|---|---|
| | Layout | Old Machine* | Motor (VDC) | Speed (Sec.) | Gear Ratio | Options Ref.** |
| N451160-0501 | L.H. | N320310-005 | 20 | 15 | 360:1 | C,N |
| N451160-0505 | L.H. | N320514-002 | 20 | 26 | 528:1 | C,F,E,N |
| N451160-0508 | L.H. | N328499 | 20 | 15 | 360:1 | N |
| N451160-0511 | L.H. | N381743-001 | 110 | 4.5 | 189:1 | B,N |
| N451160-0513 | L.H. | N398218-001 | 20 | 26 | 528:1 | G,N |
| N451160-0522 | L.H. | -- | 20 | 26 | 528:1 | B,N |
| N451160-0524 | L.H. | -- | 110 | 4.5 | 189:1 | O,B,P,Q |
| N451160-0526 | L.H. | -- | 20 | 15 | 360:1 | N,P,J |
| N451160-0528 | L.H. | -- | 110 | 4.5 | 189:1 | N,R,B |
| N451160-0502 | R.H. | N320310-006 | 20 | 15 | 360:1 | C,N |
| N451160-0503 | R.H. | N320514 | 20 | 26 | 528:1 | N |
| N451160-0504 | R.H. | N320514-001 | 20 | 26 | 528:1 | C,F,E,N |
| N451160-0507 | R.H. | N328498 | 20 | 15 | 360:1 | N |
| N451160-0510 | R.H. | N381743 | 110 | 4.5 | 189:1 | B,N |
| N451160-0514 | R.H. | N399387-002 | 110 | 4.5 | 189:1 | C,N |
| N451160-0521 | R.H. | -- | 20 | 26 | 528:1 | B,N |
| N451160-0523 | R.H. | -- | 110 | 4.5 | 189:1 | O,B,P,Q |
| N451160-0527 | R.H. | -- | 110 | 4.5 | 189:1 | N,R,B |
| N451160-1201 | R.H. | -- | 110 | 4.5 | 189:1 | B,O,S |
| N451160-1202 | L.H. | -- | 110 | 4.5 | 189:1 | B,O,S |
| N451160-1203 | L.H. | N399387-003 | 110 | 4.5 | 189:1 | O |
| N451160-1204 | R.H. | N381743 | 110 | 4.5 | 189:1 | B,O |
| N451160-1205 | L.H. | N381743-001 | 110 | 4.5 | 189:1 | B,O |

*For reference only **Refer to Configuration Guide on previous page

## M-23B Electric Switch Machine

| US&S Order No. | Description | | | | | |
|---|---|---|---|---|---|---|
| | Layout | Old Machine* | Motor (VDC) | Speed (Sec.) | Gear Ratio | Options Ref.** |
| N451160-0602 | L.H. | N321365-001 | 20 | 15 | 360:1 | D,N |
| N451160-0609 | L.H. | N388786 | 110 | 4.5 | 189:1 | N |
| N451160-0612 | L.H. | N394803-001 | 110 | 4.5 | 189:1 | B,N |
| N451160-0614 | L.H. | N438177 | 20 | 26 | 528:1 | J,N |
| N451160-0601 | R.H. | N321365 | 20 | 15 | 360:1 | D,N |
| N451160-0604 | R.H. | N321366-001 | 20 | 26 | 528:1 | N |
| N451160-0611 | R.H. | N394803 | 110 | 4.5 | 189:1 | B,N |
| N451160-0615 | R.H. | N438177-0001 | 20 | 26 | 528:1 | J,N |

*For reference only *Refer to Configuration Guide on page 5A(3)

## Standard M-3, M-23A, M-23B - *Retrofit Kit for Field Wound Motor*

| US&S Order Number | Old Motor* | Description |
|---|---|---|
| X451160-1101 | N306349 | Voltage: 110 Vdc, Gear Ratio: 189:2 |
| X451160-1102 | N150293 | Voltage: 20 Vdc, Gear Ratio: 360:1 |

*For reference only

## Style "M" Switches - *Retrofit Latchout Kit*

| US&S Order No. | Description |
|---|---|
| X451161-4901 | Retrofit Latchout Kit for Style "M" Electric Switch Machines (includes instructions). |

## Standard M-23A, M-23B - *Latch Stand*

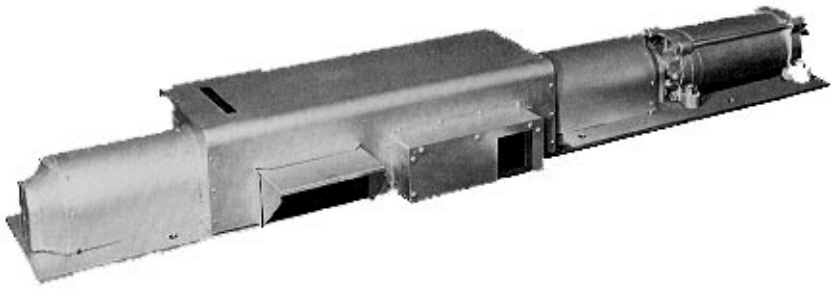
| US&S Order No. | Description |
|---|---|
| N286609 | Latch Stand (3/4" lag screw mount) for M-23A, M-23B machines |

**Contact your US&S Sales Rep. or Customer Service for pricing information*

**Note**

M-23, M-23A, or M-23B Point Detector Bars, Lock Rods and Lock Connecting Rods ordered separately from machines. Refer to page 5K(1) for ordering info.

# A-5 Electro-Pneumatic Switch Machine



## General

The A-5 Electro-Pneumatic Switch Machine is designed for use with single switches, double slip switches and/or movable point frogs. It can be readily adapted to right or left-hand layouts without needing additional parts. The A-5 is a time proven, reliable switch machine that incorporates point detection in the circuit controller.

Primary components of the A-5 include an air cylinder, slide bar and single escapement crank for single switch and double slip applications. The escapement crank is equipped with an adjustable operating rod arm that may be adjusted to satisfy any switch stroke in common use. Additionally, it has ample motion in the switch basket for meeting any increased switch stroke that may develop due to wear or shifting of the stock rail.

Air cylinder sizes are proportioned so that any machine, when applied to the proper layout, will operate properly (under ordinary conditions) on a minimum air pressure of 50 psi. A feature of the machine's slide bar is a friction lock that provides resistance against creepage. All A-5 versions contain a circuit controller and a base plate for direct mounting to the tie.

## Ordering Information

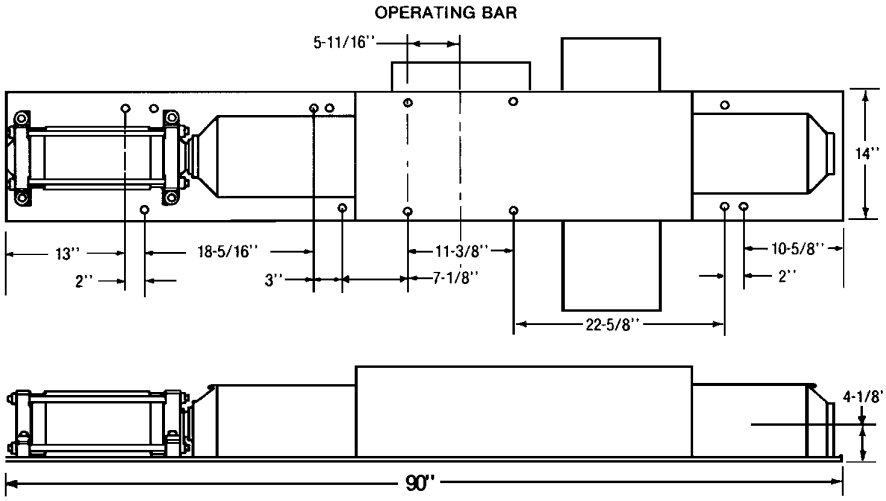
- Operates down to 50 PSI pressure
- Adjustable operating rod arm
- Remote or on-site manual operation
- Right or left-hand layouts

## Ordering Information

- A-5 switch machines and covers listed in table on the next page.
- Order covers separately
- If ordering A-5 machines for a new switch layout, please supply all required specifications and mounting dimensions according to approved track plans (contact US&S Sales for any needed assistance.)

## Service Manual Reference

- Refer to **SM 5044** for detailed specifications and parts list.




## Note

The illustration at left shows dimensions for single switches and double switches only. Contact US&S Sales for dimensions of moveable point frog machines.

## A-5 Switch Machines

| US&S Order No. | Description | | | |
|---|---|---|---|---|
| | Cover Part No.* | Layout | Cylinder Dia. | Comments |
| N181788 | X439042-001 | L.H. | 5" | -- |
| N181789 | X439042 | R.H. | 5" | -- |
| N394484 | X439042-001 | L.H. | 5" | -- |
| N397632 | X439042 | R.H. | 5" | |
| N294251 | X439042-001 | L.H. | 5" | w/heater |
| N294252 | X439042 | R.H. | 5" | w/heater |
| N294253 | X439042 | R.H. | 6" | w/heater for double slip switch |
| N294254 | X439042-001 | L.H. | 6" | w/heater for double slip switch |
| N294266 | X439043 | L.H. | 6" | w/heater for movable point frog |
| N294267 | X439043 | R.H. | 6" | w/heater for movable point frog |

*Covers ordered separately (see table below).

### Covers - *complete set*

| US&S Order Number | Applications |
|---|---|
| X439042 | R.H. single switch or double slip |
| X439042-001 | L.H. single switch or double slip |
| X439043 | R.H. or L.H. movable point frog |

UNION SWITCH & SIGNAL

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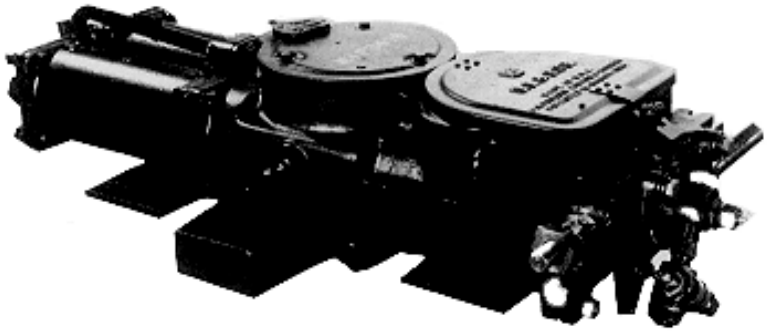
# A-10 Electro-Pneumatic Switch Machine



## Features

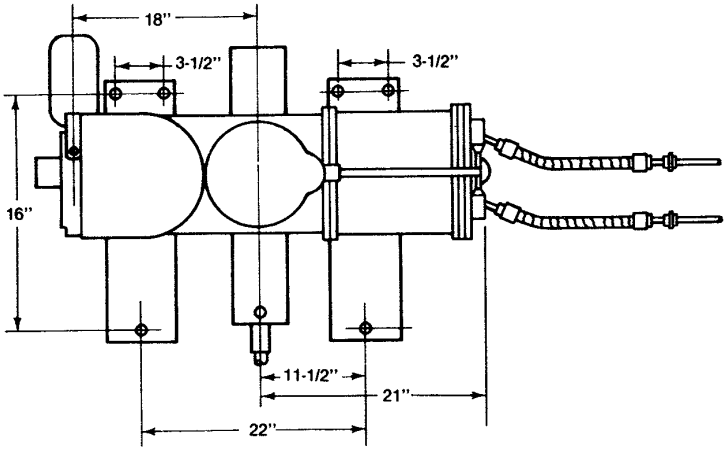
- Designed for single switch installations
- Ideal in transit tunnels and other tight spaces
- Right or left-hand layout
- Built-in circuit controller and point detector
- Interchangeable parts

## General

The A-10 Electro-Pneumatic switch machine is a rack and pinion type machine. It employs two identical single acting air cylinders with identical piston assemblies, a vertical crank shaft, a circuit controller and a point detector mechanism. The switch assembly is encased in a rugged case iron housing with mounting flanges for direct mounting to the track ties.

The A-10 incorporates a radial arm point detector mechanism. Movement of the detector arm causes a shift in the circuit controller contacts. This prevents making indication contacts unless both the machine and the switch point are in their full respective normal or reverse position. The detector mechanism is designed to escape wear from frequent operation of the switch and from external vibrations. Effects of switch stroke variation are compensated by adjustment of external mechanical parts.

All A-10 machines are provided with a hand crank for manual operation. For safety, the crank cannot be meshed with the crank's gear until the valve yoke has been removed, which cuts off the machine's air supply. Conversely, to return to power operation, the hand crank must be removed.




## Ordering Information

- Standard A-10 switch machines listed below
- Contact US&S Sales to order heaters for motor and circuit controller; recommended for extreme cold weather installations
- If ordering A-10 machines for a new switch layout, please supply all required specifications and mounting dimensions according to approved track plans (contact US&S Sales for any assistance needed)

## Service Manual Reference

- Refer to **SM 5041** for detailed specifications and parts list.

## A-10 Machines

| US&S Order Number | Description |
|---|---|
| N159020 | A-10 Electro-Pneumatic Switch Machine - *right-hand layouts* |
| N163419 | A-10 Electro-Pneumatic Switch Machine - *left-hand layouts* |

UNION SWITCH & SIGNAL

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# YM-2000™ Electric Switch Machine

## Features

- Trailable, fast-acting electric machine
- Low cost, reliable operation
- Hand crank, local or remote electric control
- NEMA-qualified environmental protection
- Simple design, easy maintenance

## Ordering Information

- YM-2000 switch machines listed in chart below
- If ordering YM-2000 switch machines for a new layout, please supply all required specifications and mounting dimensions according to approved track plans (contact US&S sales for any assistance needed)

## Service Manual Reference

- Refer to **SM 6455**

| US&S Order Number | Description |
|---|---|
| N451063-0301 | 110V ac Motor/ 110V ac Contactor |
| N451063-0303 | 110V ac Motor/ 24V ac Contactor |

## General

US&S's YM-2000 Electric Switch Machine is a simple, low cost machine with an excellent service record in railroad yard applications. Unlike many switch machines in its class, the YM-2000 can handle trailing moves at maximum yard speeds (up to 20 mph). This feature, combined with multiple control options and fast transition speeds, makes the YM-2000 the obvious choice among electric machines for classification yards, receiving and departure areas, industrial sidings, and flat switching or storage yards.

The YM-2000 Switch Machine is arranged in a compact, low-profile steel case that allows between-the-ties mounting close to the track. Right or left-hand layout is possible with the same machine.

Exterior surfaces are protected with Polane® epoxy paint, a new coating which provides exceptional resistance to corrosion and scratching. Stainless steel is used for all key hardware for long term corrosion protection. Overall, the machine meets the NEMA-3R standard for environmental protection of internal components. Inside, a 15W heater is provided to prevent condensation and frost formulation on electrical contacts. To allow use in tropical climates, all electrical contacts are coated with a special varnish.

The movement of the YM-2000 Switch Machine is developed by an instantly reversible, right-angle gear motor (worm type). At nominal voltage and ambient temperature the motor throws the switch points in just two seconds. Output shaft fasteners on the motor incorporate locking tabs to eliminate loosening from vibrations. Similarly, locking roll pins are used on the gear housing to maintain tightness.

An electric brake mechanism is provided on the motor to maintain switch point closure against the stock rail at the end of the stroke. The brake is electrically released by a solenoid when the motor is energized, and actuated by springs at the end of the stroke travel when motor energy is removed.

Several design features make the YM-2000 well suited for trailing moves. The machine contains a specially designed clutch that is set to slip during a trailing move, thereby preventing any resulting movement of the internal gear motor. This feature greatly reduces machine wear and potential damage. When the clutch slips, cams on the clutch housing actuate control / indication switches which energize the gear motor to move the switch points to either the full normal or full reverse position.

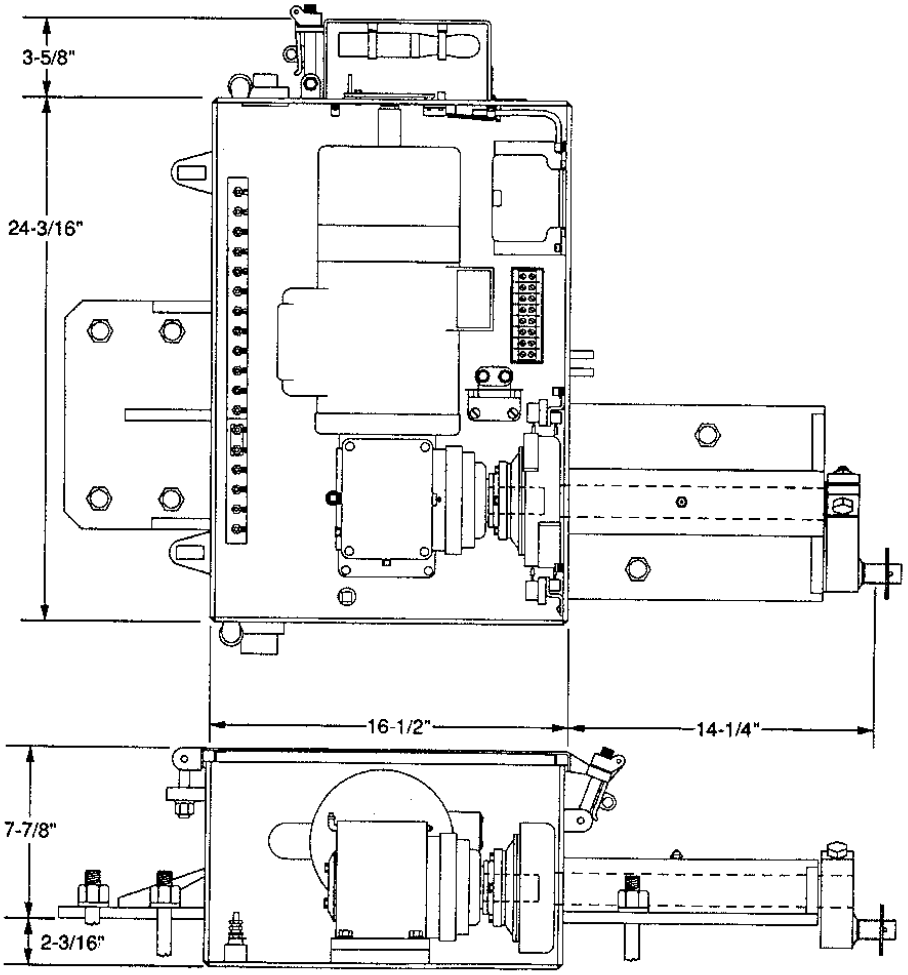
The YM-2000 can be manually operated by inserting a hand crank at the end of the drive motor. Electric control options include wayside push-button or remote office. Electric operation is automatically interrupted when the hand crank is inserted.

A US&S U-5 Circuit Controller (refer to page 5G) can be added to the YM-2000 switch layout to provide point detection. Switch points can be displayed using US&S's H-2 searchlight dwarf or ES-20 color light signals.

YM 2000™
ELECTRIC SWITCH MACHINE

## Specifications

| | | | |
|---|---|---|---|
| ***Weight*** | 250 lbs. | ***Running Current*** | 7 to 8 A @ 115 Vac, 60 Hz |
| ***Throw Distance*** | 6 in. (15.24 cm) | ***Max. Oper. Current*** | 15A ± 10% |
| ***Rated Output*** | 1000 lbs. (454 kg) | ***Operating Temp.*** | -40 C to + 70C |
| ***Throw Time*** | 2 seconds @ 115V ac, 60 Hz | ***Heater*** | 115V, 15W |
| ***Power Input*** | 110V ac (±20%), 60 Hz | ***Trailing Move*** | 20 mph (32 kph), max. |
| ***Inrush Current*** | 42A during throw @ 115V ac, 60 Hz | ***Vibration Limit*** | 1G @ 5 to 100 Hz |



UNION SWITCH & SIGNAL

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# DA-10 Electro-Pneumatic Switch Machine

## General

The DA-10 Electro-Pneumatic Switch Machine is an extremely fast, direct acting switch machine suitable for a wide variety of yard applications. It may be used in right or left-hand layouts. Any given machine can be readily converted to the alternate arrangement because of fully interchangeable parts.

The basic DA-10 Switch Machine consists of a double acting, 5" diameter cylinder with a Pilotair valve. In turn, the Pilotair valve controls the flow of air that drives the piston. This valve also provides the exhaust ports for venting the cylinder. Fittings are provided for periodic lubrication to insure a minimal amount of friction during piston rod travel.

With 100 lbs. of air pressure and a 22 Vdc supply, the DA-10 Switch Machine completes one operation (switch normal to reverse or reverse to normal) in approximately 0.4 seconds. Since air under pressure is always connected to one end position, the switch piston will always be either extended or retracted, holding the switch in position.

Switch point slamming is prevented by two "choked" exhaust ports that vent air near the end of the piston stroke.

| US&S Order Number | Description |
|---|---|
| X451646-3201 | DA-10, w/130 ohm magnet valve coil, cover, base plate |
| X451646-3202 | DA-10, w/400 ohm magnet valve coil, cover, base plate |
| N372277 | DA-10 only, w/130 ohm magnet valve coil |
| N394172 | DA-10 only, w/400 ohm magnet valve coil |
| N372039 | Cover only |
| M372070 | Base plate only |

## Specifications

| | |
|---|---|
| ***Piston*** | Double-acting, 5" dia., 6" stroke |
| ***Oper. Range*** | *Pressure*: 55 to 150 psi magnet valve power: 12-24 Vdc supply |
| ***Cycle Time*** | Normal-to-reverse or reverse-to-normal within 0.4 sec. @ 100 psi w/22 Vdc supply |
| ***Magnet Valve*** | Options: 130 or 400 ohms |

## Features

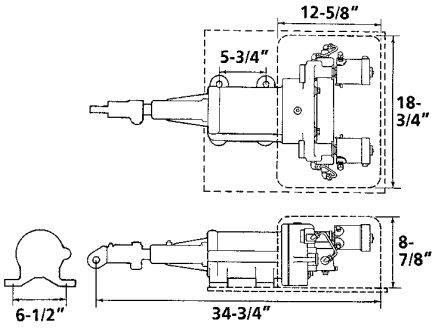
- Well suited for classification yards
- Fast acting switch movement
- Trailable operation
- Choked exhaust ports prevent point jamming

## Ordering Information

- DA-10 switch machines listed in table below
- Machine, cover and base plate can be ordered under a single "X" order (part) number, or as individual components
- If ordering DA-10 machines for a new switch layout, please supply all required specifications and mounting dimensions according to approved track plans (contact US&S sales for any needed assistance)

## Service Manual Reference

- Refer to **SM 5708**



UNION SWITCH & SIGNAL

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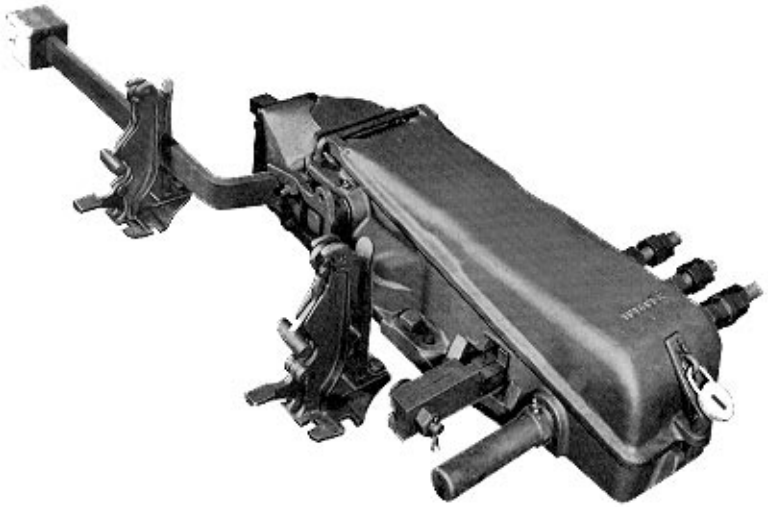
# T-20 and T-21 Hand Operated Switch Machines



## Features

- Useful where facing point lock protection is needed
- Positive action, rugged construction

## Ordering Information

- T-20 switch machines and T-21 target staffs listed on next page
- To order a T-21 machine, add target staff to T-20. Target staff is rod only; not indicator
- Actual target not included
- If ordering T-20/T-21 machines for a new switch layout, please supply all required specifications, and mounting dimensions accord ing to approved track plans (contact US&S sales for any needed assistance)

## Service Manual Reference

- Refer to **SM 5417**

## General

The T-20 and T-21 Switch Machines are typically used where facing lock protection is required to help safeguard the movement of high speed mainline traffic over a switch. These machines use a rack and escapement type mechanism and each comes with a circuit controller.

The complete operating mechanism is enclosed in a rugged cast iron case with a lockable cover. “T-20” is the basic hand operated switch machine, while “T-21” is a T-20 equipped with a target staff.

These switch machines contain a lock bar which, with the switch in the normal position, enters a notch in the lock rod. This arrangement locks the switch points in their normal position to provide facing point lock protection. In addition, the escapement crank mechanism is configured so that the driving system itself locks the switch in either extreme position.

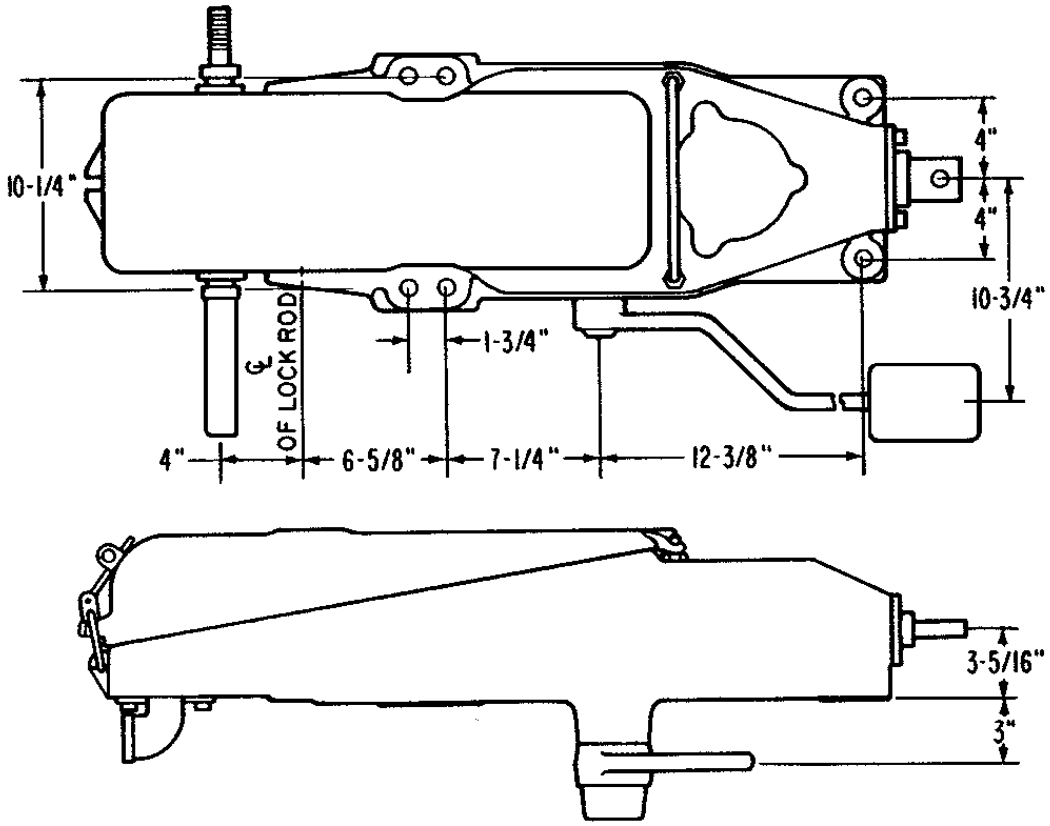
Three basic types of circuit controllers are available with the T-20 or T-21 Switch Machines, including standard, standard with reverse point detection, and heavy duty. These contain up to four normally open or closed contacts which are operated jointly by the lock rod and the point detector bar.

The contacts indicate whether the switch is in the proper position for facing point moves. In the standard controller equipped for reverse point detection, the reverse detector device contains four additional pairs of contacts that indicate switch points in the reverse direction.

The T-20 and T-21 Switch Machines may be used in right or left-hand layouts. Although the machines are externally configured for left or right layouts, all parts are interchangeable to allow conversion to the opposite layout.

| US&S Order Number | Description | | | | | |
|---|---|---|---|---|---|---|
| | Controller Contacts* | Reverse Point Det. | Switch Pt. Layout | Closed | Lock Bar** | Notes |
| N212768 | 4 Open | No | L.H. | L.H. | Rack | 1 |
| N212769 | 4 Open | No | L.H. | L.H. | Ind. | -- |
| N212788 | 4 Open | No | R.H. | R.H. | Ind. | -- |
| N212789 | H.D. | No | L.H. | L.H. | Rack | 1 |
| N212795 | H.D. | No | L.H. | L.H. | Ind. | 1 |
| N212732 | H.D. | No | R.H. | R.H. | Ind. | 1 |
| N385635-0002 | 2 Open, 2 Closed | No | L.H. | L.H. | Rack | -- |
| N385635-0003 | 2 Open, 2 Closed | No | L.H. | R.H. | Rack | -- |
| N385636 | 4 Open | No | R.H. | R.H. | Rack | -- |
| N385636-0002 | 4 Open | No | L.H. | L.H. | Rack | -- |
| N386637 | 2 Open, 2 Closed | No | R.H. | R.H. | Rack | -- |
| N385637-0002 | 2 Open, 2 Closed | Yes | L.H. | L.H. | Rack | -- |
| N383605 | Conversion to T-21 machine: Low target staff, 15-5/8" high | | | | | |
| N383607 | Conversion to T-21 machine: High target staff, 7', 5-1/16" high | | | | | |

NOTES *H.D. = Heavy Duty **Rack driven or independent 1 = Machine with heavy duty external terminals



# U-5 Switch Circuit Controller

## Features

- Provides reliable detection of switch point position
- Numerous applications
- Easily adjusted

## Ordering Information

- Circuit controller order numbers for standard or classification yard applications listed in table on page 5G(3)
- When placing order, indicate:
  - Standard or yard type machine
  - Cam arrangement
  - Contact arrangement
  - Crank offset: use tie location to determine proper offset, refer to "Z" dimension in diagram on this page
- Refer to page 5K(1) for circuit controller operating rods

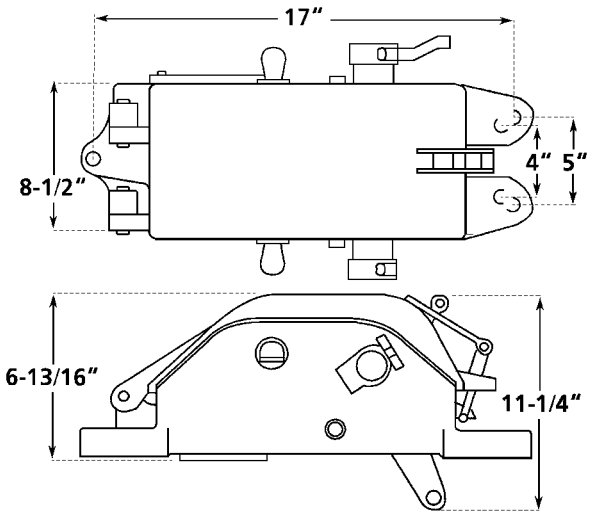
## Service Manual Reference

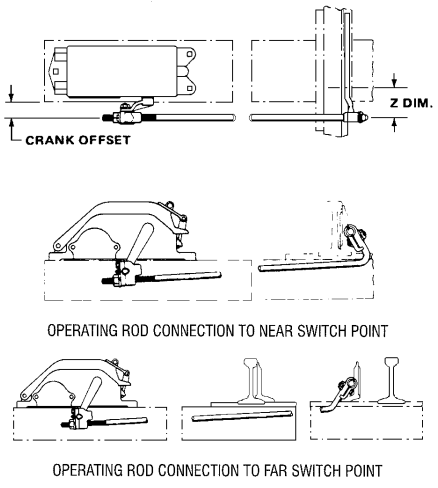
- Refer to **SM 4516**

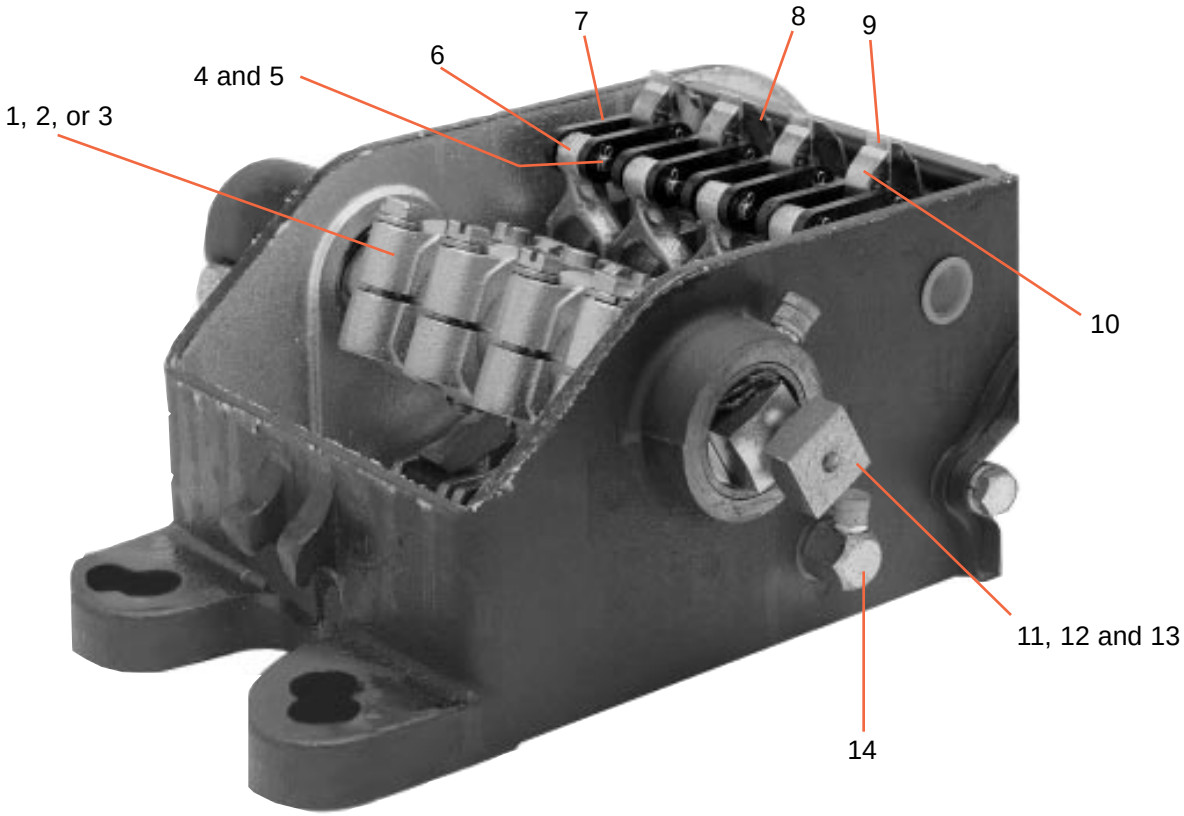
## General

The U-5 Switch Circuit Controller is a ruggedly constructed unit used for electrically detecting the position of rail switch points. It is available in four way sizes for 2-position, 3-position, and polarized applications (six-way models are also available; contact US&S sales for these models). The U-5 terminals, contacts, operating cams and other compartments are installed in a rugged and weather-tight cast iron housing. A hinged cover provides easy internal access for inspection, adjustments and maintenance. Two elbow type ventilators provide air circulation and minimize condensation within the housing. The machine's 1-1/2" shaft provides a large bearing surface, reduced bushing wear, and a large surface area to engage a micrometer adjusting screw (preventing wear and loss in sensitivity). Shaft bearings are fashioned from bronze and use pressure grease fittings.

A 2-position controller may be used without change of parts for polarized applications through cam and circuit adjustments. A 2-position controller may also be used as a 3-position controller for two circuits by using two cam spaces for each 3-position circuit and making the appropriate cam adjustments. A 3-position controller for four circuits is obtained by using combined 3-position cams in place of a 2-position cam and substitution of the cam shaft.






## Commonly Used Spare Parts - *U-5 Circuit Controllers*

| Illustration Reference | US&S Part Number | Description |
|---|---|---|
| 1 | N208349 | Cam, Complete (two-position) |
| 2 | N213511 | L.H. Cam, Complete (three-position) |
| 3 | N213512 | R.H. Cam, Complete (three-position) |
| 4 | M51765 | Pin |
| 5 | J048600 | Cotter, 1/16" x 3/8" (N.P.) |
| 6 | N181164 | Operating Arm, Complete |
| 7 | J077665 | Insulated Joint |
| 8 | N451142-2301 | Contact Spring, Complete |
| 9 | N451142-2201 | Contact Spring, Complete |
| 10 | J680201 | Contact Spring, Complete |
| 11 | M178531 | Cam Shaft for 4-way, 2-position controller |
| 12 | M194434 | Cam Shaft for 4-way, combination 2 and 3-position controller |
| 13 | M183534 | Cam Shaft for 4-way, 3-position controller |
| 14 | N181411 | Rocker Shaft (4-way) |

## U-5 Switch Circuit Controllers

| US&S Order Number | Description | | | | | | |
|---|---|---|---|---|---|---|---|
| | Appli. * | Cam Pos. | Return Spring | 3/4" (Ball Stud) | | 2-13/32" (Ball Stud) | |
| | | | | Insulated | Non-Insulated | Insulated | Non-Insulated |
| X184136 | Std. | 4-2 | -- | X | -- | -- | -- |
| X190700 | Std. | 4-2 | -- | -- | -- | X | -- |
| X244167 | Std. | 4-2 | -- | -- | -- | -- | X |
| X218085 | Std. | 4-2 | X | X | -- | -- | -- |
| X199187 | Std. | 4-2 | X | -- | X | -- | -- |
| X229482 | Std. | 4-2 | X | -- | -- | X | -- |
| X257184 | Std. | 4-2 | X | -- | -- | -- | X |
| X209313 | Std. | 2-2<br>2-3 | -- | X | -- | -- | -- |
| X207228 | Std. | 2-2<br>2-3 | -- | -- | X | -- | -- |
| X236956 | Std. | 2-2<br>2-3 | X | -- | X | -- | -- |
| X191911 | Std. | 2-2<br>2-3 | X | -- | -- | X | -- |
| X194433 | Std. | 2-2<br>2-3 | X | -- | -- | -- | X |
| X184035 | Std. | 4-3<br>3-3 | -- | X | -- | -- | -- |
| X371946 | Yard | 1-2 | -- | X | -- | -- | -- |

UNION SWITCH & SIGNAL

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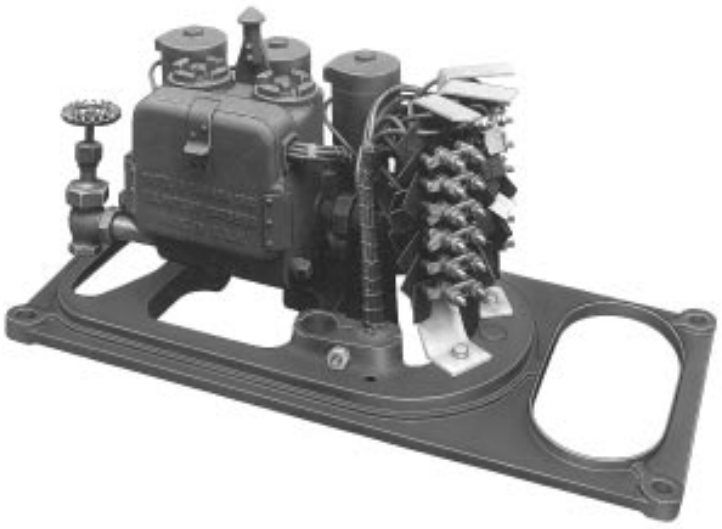
# CP Switch Valve



## Features

- Precision control of switch machine air
- Outstanding service record,highly adaptable

## Ordering Information

- CP Switch Valve and cast-iron base listed in chart on this page

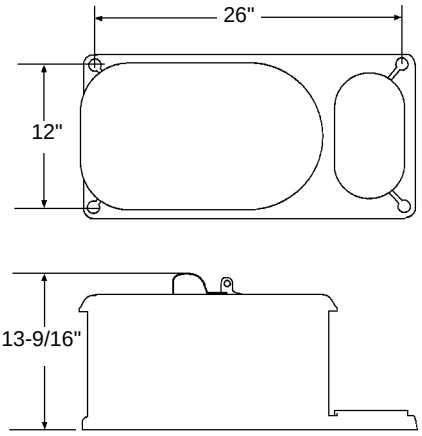
## Service Manual Reference

- Refer to **SM 5410**

## General

CP Switch Valves control the compressed air feed to electro-pneumatic switch machines in both mainline and transit applications. The valve assembly consists of three electromagnets, three pin valves, two pistons, two poppet valves, a terminal board and a circuit controller. These precision made components and external items such as piping, hoses and fittings are mounted on a common, cast iron, rectangular base. The complete assembly is shielded with an easily removed cover. CP Switch Valves incorporate DC magnets having 2-piece caps with finger holes. Magnet coils are available with a 130 ohm coil. The complete unit meets all applicable AAR standards.

The CP Switch Valve is designed for mounting on a cast iron or concrete foundation. Cast iron foundations from US&S (refer to ordering tabulation) are fashioned for a perfect fit to the valve base and use accurately placed knockouts for trunking or parkway cables.




| US&S Order Number | Description |
|---|---|
| N109898<br>X161412-001 | CP Switch Valve, w/130 ohm magnet coil.<br>Cast iron foundation for CP Switch Valve, mtg. centers 12” x 26", 24" elevated. |

# SL-25 and SL-26 Switch Locks

## Features

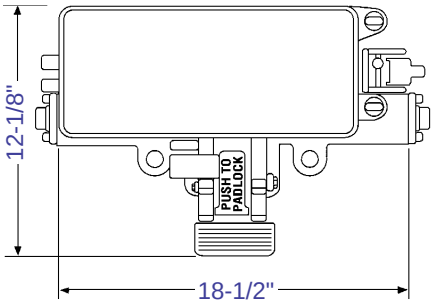
- Low style locks for installations in places with unusual space restrictions
- Single and tandem applications

## Ordering Information

- SL-25 and SL-26 units with normal contact arrangement, no key release, listed in chart on this page
- When placing order, indicate the type of switch stand used in the installation
- Contact US&S sales to order key accommodations

## Service Manual Reference

- Refer to **SM 5466**




## General

The SL-25 and SL-26 are low style electric switch locks for application to locking levers located between the rails at the middle of hand operated crossovers (where clearance is limited to 7"). These devices employ a foot operated latch with padlock, a magnet assembly, armature contacts, cam operated controls, plunger rod and a mechanical status indicator (LOCKED, UNLOCKED).

The SL-25 has three cam operated contacts (2 normally closed, one open) for line control, while the SL-26 has six heavy duty contacts (open in the padlocked position) for direct track shunting in non-electrified areas. Both versions indicate the position of the magnet armature.

Both switch locks may be ordered with an emergency key release unit, either a Yale or Switchman's key types. A latchout feature is also available; this feature places the contacts in their most restrictive indication if an emergency key is used. Locks suitable for tandem can also be ordered.

| US&S Order Number | Description |
|---|---|
| N269804<br>N260400 | SL-25 lock, w/280 ohm magnet coil.<br>SL-26 lock, w/440 ohm magnet coil, 1-1/2" adapter for waterproof cable outlet. |

# SL-21A Electric Switch Locks

## Features

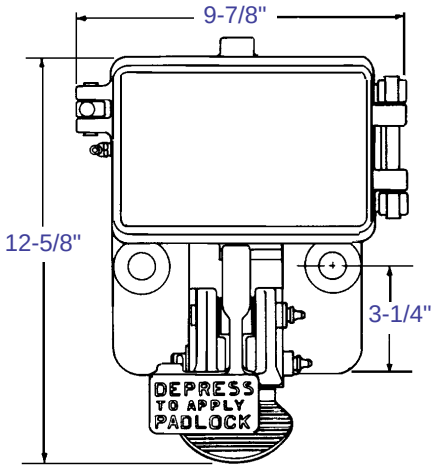
- Provides security for hand throw switch levers
- Positive locking, low profile
- Easily installed and maintained

## Ordering Information

- Switch lock listed in chart on page 5K(2) SL Lever Lock Rod Support
- When ordering the SL-21A Switch Lock, specify if wire inlet plate assembly is to be installed on the hasp or hinge side
- Also specify type of switch stand that will incorporate the lock
- Lever lock rod does not have a standard order number. Order by dimensions shown in illustration on page 5K(2).
- Contact US&S Sales to order:
  - Yale Drawer lock
  - Lock suitable for tandem application (locking hand-throw lever in both normal and reverse positions)

## Service Manual Reference

- Refer to **SM 3225**



## General

The SL-21A Electric Switch Lock prevents unauthorized operation of hand throw levers on switch stands. An electric control in the SL-21A provides the only means of disengaging the lock. Basic components include a magnet coil, armature, cam operated contacts, locking dog assembly (with two counterweights), and foot latch assembly. The complete mechanism is housed in a low profile cast iron case and uses a foot latch with a padlock for added security.

In the normal position, the foot latch is pressed and the padlock is in place. When the padlock is removed, a coil return spring raises the foot latch, applying voltage to the lock circuit and energizing an armature. This results in lifting of the lock dog from its notch and releasing the mechanism. The switch can be thrown at this point. The spring-loaded foot latch must be pressed to enable insertion of the padlock. This action removes the voltage, causing the armature to fail away and the lock dog to drop back into place, thus securing the mechanism. Counterweights assist the motion of the lock dog.

Normal arrangement of the cam operated contacts are for the padlocked position. The back contacts are closed and the front contact is open in this position. Typically, there are one front and two back contacts, while the armature normally has two back contacts that are closed when the circuit is de-energized.

The SL-21A is for right-hand assembly. Other optional items include lock rod and lock rod support. US&S can produce custom lock rods to customer specifications.

# Miscellaneous Switch Layout Parts / Assemblies

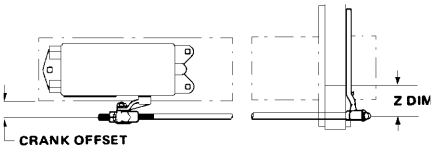
## Circuit Controller Operating Rods and Point Detector Lugs

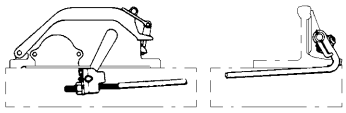
Circuit controller operating rods connect the controller directly to a switch point. Connections can be made to the near or far switch points. The following two types of rods are available:

- With spring type ball socket for circuit controller connection and ball clamp for switch point connection
- With spring type ball socket for both connections

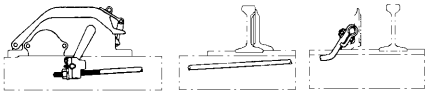
The ball sockets are self-adjusting. Lost motion in the connections is automatically taken up by the spring, which has ample strength to operate the circuit controller. The ball connection is captive and can not escape from the socket even if the spring should break. A grease fitting on the spring ball socket connection enables forced lubrication.

All rods incorporate a thread with rounded roots to withstand severe vibrations over an extended period. Ball type point detector lugs are recommended for these rods; these listed below.

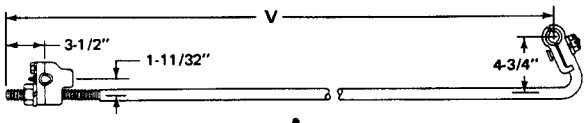


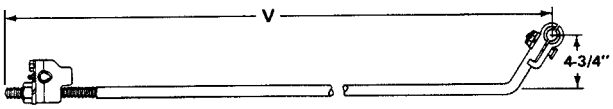
OPERATING ROD CONNECTION TO NEAR SWITCH POINT



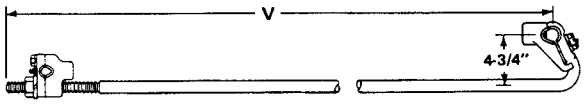
OPERATING ROD CONNECTION TO FAR SWITCH POINT




A




B

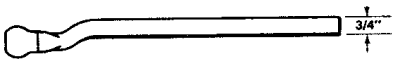


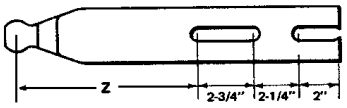

C

## Circuit Controller Operating Rods

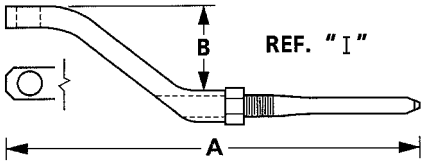
| US&S Order No. | Description | | |
|---|---|---|---|
| | Ref. | End Connections* | Dimension "V" |
| N237118 | A | Spring, Ball | 2' 3-1/4" |
| N221255 | A1 | Spring, Ball | 2' 9-1/2" |
| N224218 | A2 | Spring, Ball | 3' 10-1/2" |
| N225193 | B | Spring, Ball | 7' 11-1/2" |
| N224456 | C | Spring, Spring | 3' 10-1/2" |

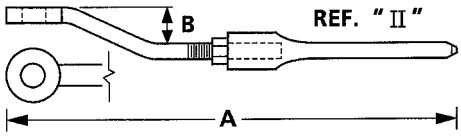
*Ends of rod: "Spring"= Spring type ball socket;
"Ball" = Ball Clamp




C.C. OPERATING ROD – POINT DETECTOR LUG




## C.C. Operating Rods - Point Detector Lugs

| US&S Order No. | Description | |
|---|---|---|
| | Bolt Application | Dimension "Z" |
| M346588 | 3/4" | 5" |
| M346589 | 3/4" | 7" |
| M346590 | 3/4" | 9" |
| M346591 | 1" | 5" |
| M346592 | 1" | 7" |
| M346593 | 1" | 9" |

## SL Lever Lock Rod Support

| US&S Order Number | Description | |
|---|---|---|
| | Magnetic Coil (Ohms) | Comments |
| N241331 | 670 | Normal contact arrangement w/lubrication fittings |
| N272885 | 280 | |
| M105987 | Stud (Qty = 1) for lock rod support | |
| J048090 | Nut (Qty = 1) for lock rod support | |
| J048622 | Cotter (Qty = 1) for lock rod support | |
| J047783 | Washer (Qty = 1) for lock rod support | |
| J039137 | Fitting (Qty = 1) for lock rod support | |
| N263471 | Lever Lock Rod Support | |

## SL Lever Lock Rods

| US&S Order No. | Description | | | |
|---|---|---|---|---|
| | Dim. A | Max. | Min. | Dim. B |
| N277576* | 10-3/16" | 11-1/2" | 10-3/16" | 1-3/4" |
| N295291* | 14-1/2" | 15-3/16" | 13-7/8" | 4-1/16" |
| N295293* | 24-1/2" | 25-3/16" | 23-7/8" | 4-1/16" |
| N309211* | 24-1/2" | 25-3/16" | 23-7/8" | 2-9/16" |
| N313979* | 12-1/16" | 12-1/2" | 11-5/8" | 1-1/16" |
| N313979-001** | 12-5/16" | 12-3/4" | 11-7/8" | 1-5/8" |
| N313979-002** | 10-15/16" | 11-3/8" | 10-1/2" | 1-5/8" |
| N313979-004** | 12-5/16" | 12-3/4" | 11-7/8" | 3-1/8" |
| N329977** | 12-5/16" | 12-3/4" | 11-7/8" | 2-1/8" |
| N313979-005** | 12-5/16" | 12-3/4" | 11-7/8" | 3/4" |

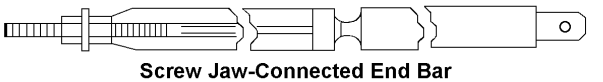
*Ref. I: For SL-21A Switch Locks on std. hand-throw switch stands

**Ref. II: For SL-21A, SL-25/26 Switch Locks on T-20/T-21 Switch Mach.

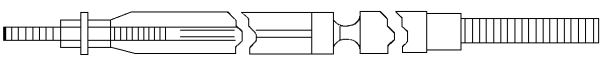
## Point Detector Bars - M-3, M-23A, and M-23B Switch Machines

US&S provides two types of point detector bars for M-3, M-23A, and M-23B electric switch machines. These bars are constructed of high strength steel and are designed for a specific point detector connecting rod. Each rod is designed for mating with a ball end type point detector lug or stud.

| US&S Order No. | Description |
|---|---|
| N284475 | Screw jaw connected end |
| N285907 | Threaded end |

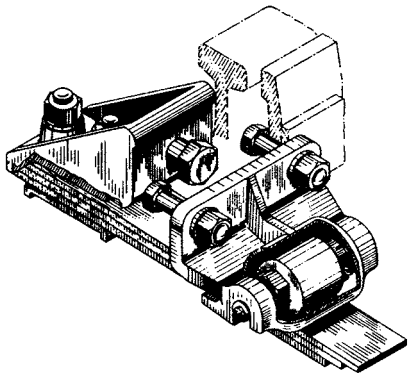


Screw Jaw-Connected End Bar



Threaded End Bar

## Switch Point Roller Bearing Assembly



US&S's switch point roller bearing assembly is a simple, inexpensive device that greatly reduces friction between the switch points and the supporting surfaces. Installed in sets, the bearings reduce the load on the switch machine and allow the machine to apply force in a smooth, uniform manner. This helps to extend machine operating life. These roller bearings can be used on mechanically operated switches, switch springs with mechanical facing point lock, and outlying power operated switches. Models are available to suit different rail sizes. The bearing used is a high quality Timken (tapered type) that is fully sealed against moisture and debris.

| US&S Order Number | Description | | |
|---|---|---|---|
| | Rail Applications | | |
| X231923-001* | 112# R.E.<br>112# R.E.<br>115# R.E.<br>119# C.F.&1<br>127# Dudley | 129# T.R.<br>130# R.E.<br>130# H.F.<br>131# R.E.<br>132# R.E. | 132# H.F.<br>133# R.E.<br>130# C.F. & 1<br>140 # P.S. |
| X231923-002** | 112# R.E.<br>112# H.F.<br>115# R.E.<br>119# C.F.&1<br>127# Dudley | 129# T.R.<br>130# R.E.<br>130# H.F.<br>131# R.E.<br>132# R.E. | 132# H.F.<br>133# R.E.<br>136# C.F. & 1<br>140# P.S. |

* One assembly for 1/2" to 1-1/4" reinforcing bar on gage side

** Two assemblies for 1/2" to 1-1/4" reinforcing bar on gage side

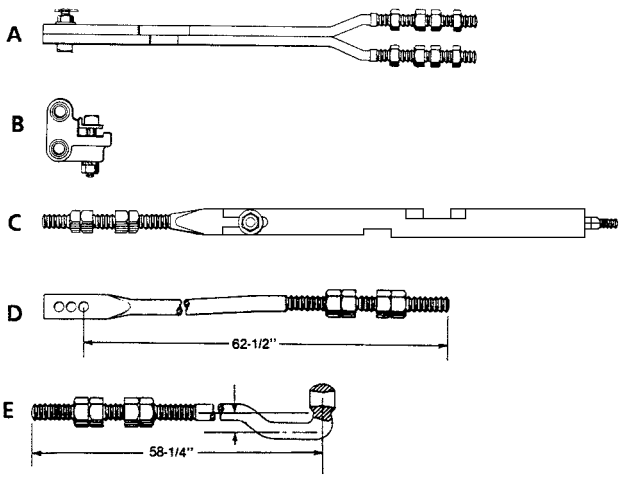
NOTE Order only when using Cal-Rod switch heaters

### Ordering Information

- Select assembly per rail weight and reinforcing bar thickness ranges and specify the required quantity
- Order no. X231923-002 includes two roller bearing assemblies
- Contact US&S Sales to order custom assemblies

## Lock Rods and Lock Connecting Rods - M-3, M-23A, and M-23B Switch Machines

Lock rods are available in several configurations to accommodate different M-3, M-23A, and M-23B switch machine installations. The rods are constructed of high strength steel and feature adjustable notch spacing for optimum compatibility with various installations. Lock rod connecting rod lengths are for a nominal dimension of 45" from gage to center of machine.




| US&S Order No. | Ref. | Description |
|---|---|---|
| N149866 | A | Lock rod for lug N123471 (below) |
| N123471 | B | Lock rod lug for L.R. connecting rod N332195 (below) |
| N258643 | C | Lock Rod for L.R. connecting rod N258686 (below) |
| N332195 | D | L.R. connecting rod - lug end |
| N258686 | E | L.R. connecting rod - spherical end |

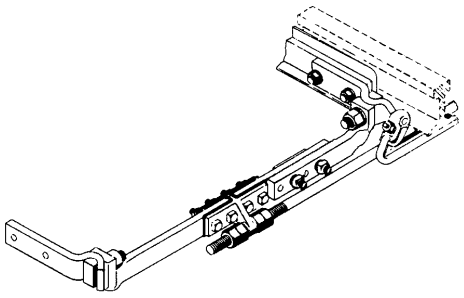
### Ordering Information

- Contact US&S Sales to order lock rod connecting rods for gage-to-machine center length other than 45"

## Swivel Front Rods and Swivel Point Lugs

US&S's Swivel Front Rods are designed as rugged, long-lasting alternatives to conventional rigid front rods. While providing a connection of great strength between the switch points, the unique swivel design permits the movement necessary to limit strain or prevent breakage of the connection resulting from stagger in switch point position. The design allows a swivel action in the horizontal plane at each end while, at the same time, providing the desired rigidity in the vertical plane for support of the switch point. All parts are forged as one piece, no welds.

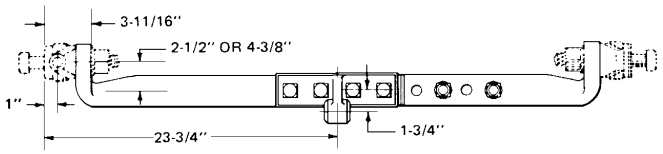
In these assemblies, the front bar is insulated at the lock rod connection lug. Its length is adjustable in 1/8" steps, providing a wide range of lengths to accommodate the various thicknesses of reinforcing bars and the various switch point openings typically encountered. The rods are made from high strength steel and may be employed in switch layouts having a distance between inside faces of point reinforcing bars of 4', 3-1/2" (max.) to 3', 11-1/8" (min.)



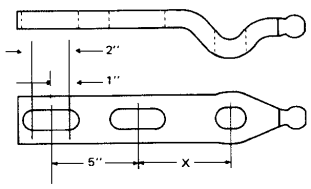
The swivel point lugs provide a secure link between the swivel front rod and the switch track, and are actuated by a connecting rod. Two types are available. One is supplied with a ball tip for mating with a point detector connecting rod. The other is furnished with a plain end. The lugs are symmetrical about the switch point bolt holes and can, therefore, be interchanged. Since the lock rod connection may be run from either side to the bracket lug, the same front rod parts are used at right-hand layouts. Refer to the charts below for complete ordering information on both swivel front rods and swivel point lugs.

### Swivel Point Lugs

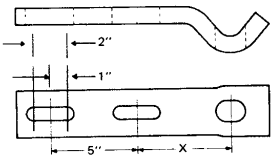
| US&S Order No. | Description | | |
|---|---|---|---|
| | Dim. X | Bolt. Appli. | End |
| M286016 | 4-1/2" | 1" | Ball |
| M297146 | 5-1/2" | 1" | Ball |
| M293573 | 6-3/8" | 1" | Ball |
| M309848-001 | 4-3/4" | 3/4" | Ball |
| M257124 | 5-1/2" | 3/4" | Ball |
| M373959 | 6-3/4" | 3/4" | Ball |
| M438580-001 | 3-1/2" | 1" | Plain |
| M286840 | 4-1/2" | 1" | Plain |
| M283081 | 5-1/2" | 1" | Plain |
| M284294 | 6-3/8" | 1" | Plain |
| M280484 | 4-3/4" | 3/4" | Plain |
| M257125 | 5-1/2" | 3/4" | Plain |
| M284293 | 6-3/4" | 3/4" | Plain |




SWIVEL FRONT ROD




LUG WITH BALL END




LUG WITH PLAIN END

### Swivel Front Rods

| US&S Order No. | Description |
|---|---|
| N229002 | Rod w/2-1/2" downset, w/ 1-3/4" drop |
| N303520 | Rod w/4-3/8" downset, w/o 1-3/4" drop |
| N451387-1501 | Rod w/4-3/8" downset, w/1-3/4" drop |

### Point Bolts

| US&S Order No. | Description |
|---|---|
| M304192 | 3/4 x 5-1/4" |
| M304193 | 3/4 x 4-1/4" |
| M312567 | 1" x 4-3/4" |
| M393550 | 1" x 5-1/2" |

# Pedestal Mounted Junction Boxes

## Features

- Ideal for underground cable termination
- Numerous optional attachments
- Direct ground installation - no foundation needed

## Ordering Information

- Common use pedestal junction boxes and special fittings listed in chart below

### Pedestal Mounted Junction Boxes

| US&S Order No. | Description | | |
|---|---|---|---|
| | Ref. | Term. | Connectors |
| N386513 | A | 4 | 1 for 1/2" x 5/8"O.D. cable |
| N393981* | A | 4 | 2 for 3/8" x 1/2"O.D. cable |
| N376937 | B | 4 | -- |
| N376941 | B | 10 | -- |
| N374992 | C | 12 | -- |
| N374993 | C | 24 | -- |
| N349656 | D | 48 | -- |

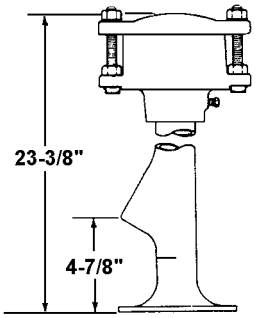
*Includes Pipe Plug

## General

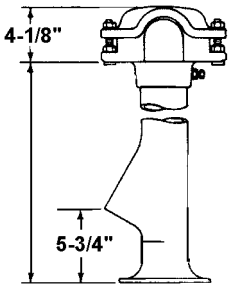
Pedestal mounted junction boxes are typically used at switch machine locations as a central termination point for underground cables. Terminal blocks, variable resistors, fuse holders and related components are mounted in these boxes.

Each pedestal contains a side entrance, located near the bottom of the riser, for the parkway cable. Because the pedestal is placed directly in the ground, no concrete foundation is required. The pedestal junction boxes can accommodate from 4 to 48 AAR terminals (#14-24) molded in blocks of bakelite insulation. Terminal nuts are positioned for easy access by a socket wrench. Knockouts for steel or flexible hose conduits or multi-conductor fittings are provided on opposite sides of the boxes. Other design features include:

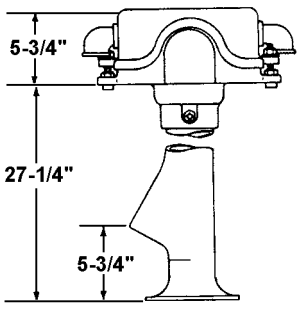
- Larger boxes (12-24 terminals) contain two elbow ventilators with fine wire mesh screens for air circulation and elimination of condensation. These boxes also have a well underneath the junction box compartment for potheading and sealing of incoming cables.
- Sealed cover joints and outside cover bolts provide weather protection
- All exposed bolts, nuts and washers are plated to resist rust
- Side and bottom openings protect incoming underground cables



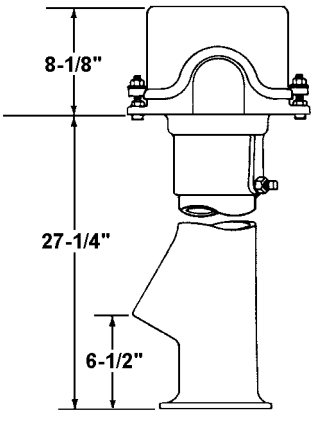

A




B

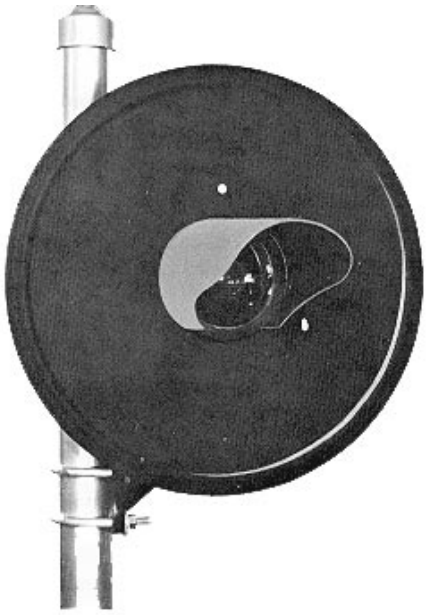



C




D

# H-2 Searchlight - *High Signal and Dwarf Signal*



## General

The H-2 Searchlight Signal provides dependable service in a variety of applications. It is designed to produce a concentrated light beam for long range indications on tangent or small curvature track. This signal is compact, rugged, lightweight and easily accessed for routine maintenance. The H-2 requires low-level operating power but provides a brilliant aspect image because of its precision optical system. It can be used for ground, bridge and dwarf signal applications.

The H-2 Searchlight Signal assembly consists of an aluminum case that houses an operative or inoperative signal unit and objective lens assembly. Adjustable mounting brackets are available for front or side-of-mast mounting of the case. The case can also be equipped with a lens hood and background. Cabling to the signal can be routed through a 45º or 90º street ell in the base. A built-in sight is provided for unit field alignment. The operative or inoperative signal unit is accurately positioned inside the case with a fixed pin and two bolts.

The operative signal unit used in the H-2 displays three color indications. External electrical connections are made on AAR terminals below the lamp unit. A plug coupler can be provided on these terminals for quick disconnection of wiring. A variable resistor (optional) allows adjustment of lamp intensity. The inoperative H-2 signal unit incorporates a single color roundel mounted in a fixed position between the lamp and lens assembly. Optical elements of the H-2 include:

- Plano-convex objective lens
- Polished elliptical reflector greatly amplifies lamp*
- Lenses made of specially developed heat resistant glass; accurately ground and polished
- Options:
  - Close-up prism for extended visibility to train crew
  - Spreadsheet roundels for indications on sharp and reverse track curves
  - Deflection roundels for typical curves
  - Inclined cover glass assemblies for deflection and diffusion on special track curvature or geographic conditions
  - Phankill for reduction of phantom indications

* Highly durable Nickel-Rhodium metal reflectors are available as direct replacements for glass reflectors (refocusing required after installation).

## Features

- Presents all aspects through a single lens
- Low power operation, but visible over great distances
- Adjustable mounting bracket with built-in aiming site
- 3-Aspect or Single Aspect models
- Precision optics

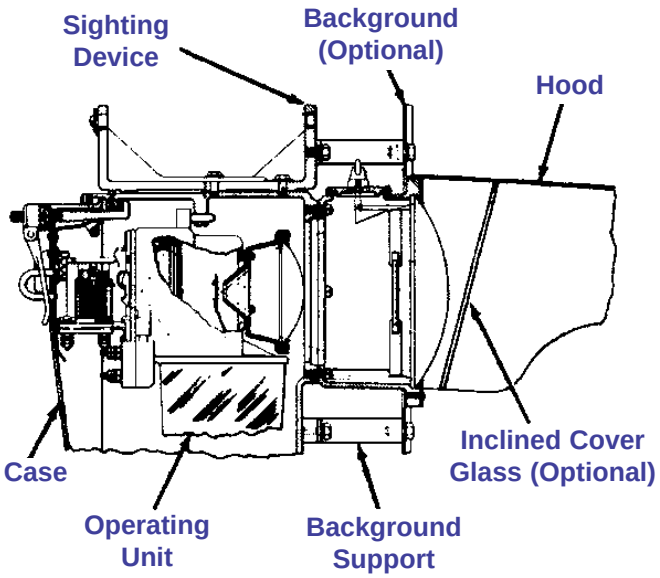
## Ordering Information

- Common-use H-2 signal components listed in chart on the next page.
- Contact US&S Sales to order customized signal units
- To order:
  1. Select type of outer signal case required from SIGNAL CASES table on the next page.
  2. Select type of operative or inoperative signal unit from SIGNAL UNITS table.
  3. Order optional background from the BACKGROUND table.

**NOTE**

Contact US&S Sales to order mounting hardware for backgrounds

- Refer to page 6I(1) to order inclined cover glass and Phankill Screen
- Refer to page 6J(1) for signal lamps.
- Refer to page 6K(2) for mainline mast assemblies




## H-2 Signal Cases

| US&S Order Number | Description | | |
|---|---|---|---|
| | Close-up Prism | Street Ell | Adjustable Bracket |
| N451353-0601 | 25º deflecting | 2", 45º | Side-of-mast at front-of-mast (at top) |
| N451353-0602 | 25º deflecting | 2", 90º | Side-of-mast at front-of-mast |

## Signal Units - Operative and Inoperative

| US&S Order No. | Description | | | | | | |
|---|---|---|---|---|---|---|---|
| | Type | Roundel | | | Coil | | Plug Coupler |
| | | Left | Middle | Right | V | Ohm | |
| N290148 | Oper. | Yellow | Red | Green | 5.5 | 250 | Yes |
| N290150 | Oper. | Yellow | Red | Green | 5.5 | 250 | No |
| N294167 | Oper. | Yellow | Red | Green | 8.0 | 500 | Yes |
| N304743 | Oper. | Lunar White | Red | Red | 5.5 | 250 | No |
| N169545 | Inoper. | Red roundel | | | | | |

## Backgrounds

| US&S Order No. | Description |
|---|---|
| M244246 | 20" background |
| M144459 | Standard, 35" diameter |

## Outside Lens (Non-Inclined)

| US&S Order No. | Description |
|---|---|
| J053746 | 8-3/8" clear lens |

# ES-20 Color Light - *Electrical Switch Signal*

## Features

- Power switch position indication or light repeater
- Front / Back indication

## Ordering Information

- Common use ES-20 signals (complete assemblies) listed in chart on next page
- Contact US&S Sales to order special configurations not indicated on this here
- Refer to page 6J(1) to order signal lamps

## Service Manual reference

- Refer to **SM 6334**

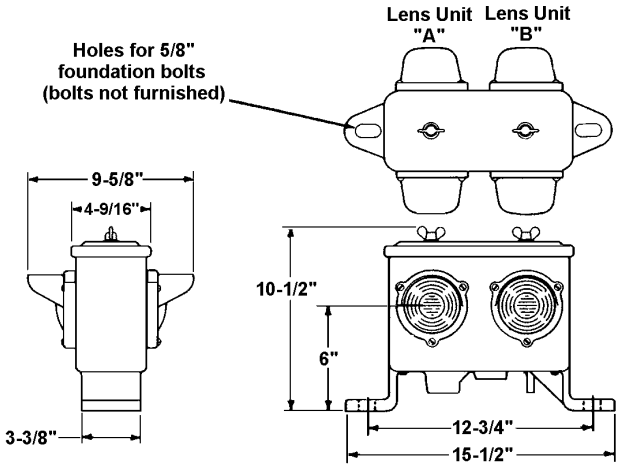
### General

The US&S ES-20 Color Light Electric Switch Signal is typically used for indicating the position of power operated switches at classification and car storage yards. However, its design permits use as a light repeater of switch position wherever electric energy is available for lighting purposes.

The signal's weatherproof housing contains a lens doublet in each of four openings; a lamp unit is placed at the focal point between each set of doublets. Each of the doublets consists of a clear lens and a colored spreader glass for horizontal spread in each direction. A wire screen is located between the clear lens and the spreader glass to protect against phantom indications.

Wing nut locking devices are used to secure the unit's top cover. This allows easy removal for access to internal components such a lamps and terminals. A hinged hasp is available on some models to permit pad locking of the cover.

Some ES-20 units are shipped with two or three blanking plates to replace selected lens sets. An integral mounting base allows quick and easy mounting of the unit. All ES-20 models include lens hoods.




| US&S Order Number | Description | | | |
|---|---|---|---|---|
| | Lenses* | | Lamp Receptacle | Lamp Receptacle |
| | A | B | | |
| N451351-0202 | G | R | S-11 S.C.B.C. | |
| N451351-0206 | G | Y | S-11 S.C.B.C. | -- |
| N451351-0208 | G | Y | Screw Base | -- |
| N451351-0204 | R | Y | S-11 S.C.B.C. | -- |
| N451351-0216 | B | Y | S-11 S.C.B.C. | -- |

* G = Green
Y = Yellow
R = Red
B = Blue

# CR-2 Signal

## General

US&S's CR-2 signal satisfies railroad industry demands for low cost, easy service 3-aspect color light signals. The latest improvements in optics, mechanical and electrical assemblies are employed.

Three light units in a square (rounded corner) housing with factory aligned low wattage lamps. Each light unit is externally shielded with a clear, high-impact Lexan lens (8 3/8"), while color is generated through a 5" interior lens.

The bulb type is a standard single contact bayonet base. Anti-phantom screens are available to prevent generation of false aspects. The total lamp/lens configuration is designed to produce a brilliant image at long range in bright sunlight or poor visibility.

Adjustable transformers and resistors can be ordered to calibrate lamp power and brilliance. A US&S K-10 5-way terminal strip (AAR type) is available for 5-wire installations, while a second K-10 strip is provided to terminate spare wires.

Housing construction uses heavy duty cast aluminum for long term durability, corrosion protection and resistance to vandalism. All light units are accessed through a single, lockable and ventilated rear door with a weathertight seal.

Grease fittings are provided on the door hinges to prevent jamming from rust. Hoods (10") and large diameter (36") backgrounds are attached to the housing with standard hex head cap screws; this allows mounting and removal with standard wrenches or sockets. (A standard cap screw is also used to secure the housing access door). To help maintainers take electrical measurements, a hook is provided in the lamp unit housing to hold a portable meter.

The CR-2 Triangular Color Light is easily handled at the installation site, thanks to a heavy duty lifting eye with a large, 2" hole. Signal head mounting is fully interchangeable with a Safetran bracket. The mounting permits accurate pointing in the horizontal and vertical planes, with the aid of a built-in sight.

## Features

- Vivid aspects in all ambient conditions
- Rear access lens/hood unit for simple handling and maintenance
- Numerous color options for all applications
- Single door

## Ordering Information

- Order complete CR-2 color light signal heads from the table below
- Order signals with backgrounds and replacement backgrounds from remaining tables
- Contact your US&S Sales to order the following:
  - *Color aspects or electrical provisions not shown in the tables on this page*
  - *Mast mounting brackets and hardware*
- See page 6J(1) to order lamps

### CR-2 Triangular Color Light Signal Heads

| US&S Order No. | Description | | | Resistor | Anti-Phantom |
|---|---|---|---|---|---|
| | Bottom | Top L. | Top R. | | |
| N451898-0101 | Red | Yellow | Green | -- | X |
| N451898-0103 | Red | (blank) | (blank) | -- | X |
| N451898-0105 | Red | (blank) | Green | -- | X |
| N451898-0107 | Red | Yellow | (blank) | -- | X |

### CR-2 Triangular Color Light Signal Heads with 36" Backgrounds

| US&S Order No. | Description |
|---|---|
| X451898-0102 | N451898-0101 |
| X451898-0104 | N451898-0103 |
| X451898-0106 | N451898-0105 |
| X451898-0108 | N451898-0107 |

### Replacement CR-2 Backgrounds

| US&S Order No. | Description |
|---|---|
| M451899-0801 | Background, 36" |

# PL Style Position Lights

## General

US&S provides a complete line of position light assemblies for a variety of wayside signaling applications. The PL-3 position light signal head is composed of a number of lamp units arranged in a circle pattern around a center lamp unit which incorporates a terminal box (the center lamp also serves as the mounting point for the signal head).

By illuminating proper combinations of lamp units, the signal displays various aspects. PL-3 heads are available with up to eight lamp units around the center lamp unit. By placing one PL-3 head above another, additional aspects may be displayed. For configurations of lamp units not shown in this catalog, contact US&S Sales.

Lamp unit features include: a) filament placement at parabolic mirror focus, b) 5-3/8" diameter horizontal spreader roundel for beam visibility around curves and close up indication immediately in front of signal, c) phankill screen for preventing phantom indications and d) a 5-3/8" conical cover made of shatter proof polycarbonate plastic. This cover has a “novil” yellow cover that insures signal visibility regardless of weather or background lightning conditions. When required, lamp units that display all standard signaling colors may also be supplied.

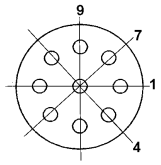
US&S also offers the PL-4 position light dwarf signal. This signal consists of a cast iron case with rear access door and containing up to four lamp units. Lamp unit features include: a) doublet lens system (2-1/4" inner and 4" outer clear lenses), and b) a 4" diffusing roundel to insure maximum range. A 2-arm version of the PL-4 is also available. This assembly is equivalent to two PL-4 signals, one atop the other, in a single cast-iron case designed for pipe mounting.

### Features

- Numerous position indications
- High, dwarf or marker versions

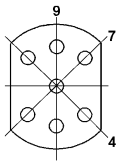
## Style PL-4 Position Lights

### Top Arm




| Aspect | Signal Complete |
|---|---|
| 1 | X348236 |
| 9 | X349435 |
| 1 - 7 | X348235 |
| 1 - 9 | X348241 |
| 1 - 4 - 7 | X434429 |
| 1 - 4 - 9 | X348239 |
| 1 - 7 - 9 | X348130 |
| 1 - 4 - 7 - 9 | X348240 |
| 4 - 7 | X349434 |
| 4 - 9 | X348 |
| 4 - 7 - 9 | X348228 |

### Bottom Arm

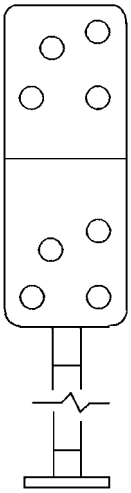



| Aspect | Signal Complete |
|---|---|
| 4 | X348234 |
| 7 | X348232 |
| 9 | X348224 |
| 4 - 7 | X348233 |
| 4 - 9 | X348227 |
| 4 - 7 - 9 | X348231 |
| 7 - 9 | X348237 |
| Marker | X348128 |

**NOTES** 1 Standard style PL-3 lens units are yellow, information on color posi tion lights is available
2 Marker is a single unit with back ground and mounting hardware

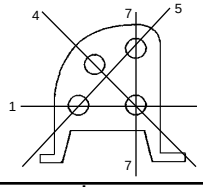
## Style PL-4 Position Lights - *Ordering References*

### Pedestal Type




| Aspect | Sig. Complete |
|---|---|
| 1 - 4 - 5 - 10 - 12 | X175937 |
| 1 - 2 - 4 - 9 - 10 - 11 - 12 | X174937-001 |
| 1 - 4 - 5 - 11 | X174937-002 |

### Dwarf Type




| Aspect | Signal Complete |
|---|---|
| 1 - 4 - 5 - 7 | N304907 |
| 1 - 5 - 7 | N438397 |

**NOTES** Style PL-4 lens units are clear

## Ordering Information

- Typical PL style signal assemblies (with mounting and electrical hard-ware) and basic signal units listed on following page for general pricing purposes.
- Contact US&S Sales to order special configurations not listed.
- Refer to section 6J (1) to order signal lamps.

## Aspect Chart

| 1 | 2 | 4 | 5 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|
| | | | | | | |  |
| |  | | | |  |  | |

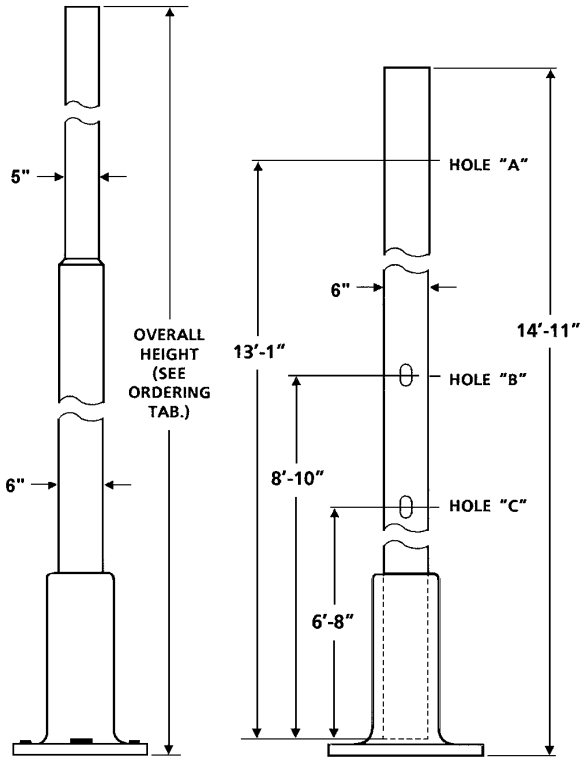
## Complete Signal Assemblies with Mechanical and Electrical Installation Hardware

| US&S Order No. | Description | |
|---|---|---|
| | Model | Aspects Displayed |
| X348231 | PL-3 | 45º lower quad - 45º upper quad - 90º |
| X348130 | PL-3 | 0º - 45º upper quad - 90º |
| X348224 | PL-3 | 90º |
| X348128 | PL-3 | Marker light |
| X174937 | PL-4 (2-am) | Top arm: 0º - 45º upper quad - 90º<br>Bottom arm: 0º - 45º lower quad - 45º upper quad - 90º |
| N304907 | PL-4 dwarf | 0º - 45º lower quad - 45º upper quad - 90º |

## Signal Unit Mounting Hardware

| US&S Order No. | Ref. | Description | Note |
|---|---|---|---|
| N136718 | H | 18'-2" mast w/socket base | 1 |
| N088456 | H | 25'-2" mast w/socket base | 1 |
| N451394-5201 | I | 14'-ll" mast w/socket base | 2 |
| N451394-5202 | I | 14'-ll" mast w/socket base | 3 |
| N451394-5203 | I | 14'-ll" mast w/socket base | 4 |
| N451394-5204 | I | 14'-ll" mast w/socket base | 5 |
| N280571 | -- | Cable outlet | -- |
| M328828 | -- | Conduit | -- |
| M095838 | -- | U-Bolt | 6 |
| J048026 | -- | Nut, 3/4" - 10 | 7 |
| J047772 | -- | Washer, 3/4" | 7 |
| M046567-001 | -- | U-Bolt | 8 |
| J048013 | -- | Nut, 1/2" - 13 | 9 |
| J047769 | -- | Washer, 1/2" | 9 |

Notes
1 Pipe diameter adapts down from 6" (base) to 5"(top)
2 Pipe diameter 6" with holes A, B and C per Ref. I
3 Pipe diameter 6" with holes A and B per Ref. I
4 Pipe diameter 6" with holes B and C per Ref. I
5 Pipe diameter 6" with holes B per Ref. I
6 Mounts PL signal to mast (2 required for each signal)
7 Hardware for above U-Bolt
8 Mounts cable outlet (1 required for each mast)
9 Hardware for above U-Bolt




Ref. H Ref. I

UNION SWITCH & SIGNAL

6E(1)
Rev. 5/97

# PL-8 Color Position Light Signal

## General

US&S's new PL-8 Color Position Light Signal offers the best features of color and position light signals, allowing a railroad to select aspect configurations perfectly suited to its particular operating requirements and rules.

Although the PL-8 is designed to house up to eight signal lamps in the familiar circular pattern, it can be augmented with additional marker lamps above and below the central array. As a result, the PL-8 can be configured to generate a highly refined series of aspects between stop and clear. The PL-8 is perfect for control of mainline trains on high traffic, close headway urban routes with numerous interlockings and passenger stations.

Constructed of light weight cast aluminum, the PL-8 Position Light Signal can be mounted on a standard concrete or steel foundation. Lamps in the circular pattern are easily accessible from the rear through a single detachable door. The door is secured by a lockable hasp on a central threaded stud.

The signal's base is designed to incorporate an additional marker lamp when desired. The base also contains ten pairs of AAR binding posts of US&S style K-10 terminal strips for external wiring. Up to six additional pairs of terminals can be added as required.

Still more lamps can be installed on top of the housing, using a mounting cap designed to hold add-on marker lamp fixtures (see diagram on following page). All doors and cover plates on the PL-8 signal use neoprene seals for weatherproofing.

Each PL-8 signal lamp location contains a 3-1/2" glass lens, a colored flat 20º spreadlite roundel to improve visibility away from the central lamp axis, and an anti-phantom screen to prevent false lamp on images.

Standard color options include AAR standard red, yellow, green, blue, and lunar white. Blanking plates are also available where illuminated aspects are not required. Individual hoods on all lamp locations are standard with all PL-8 signals.

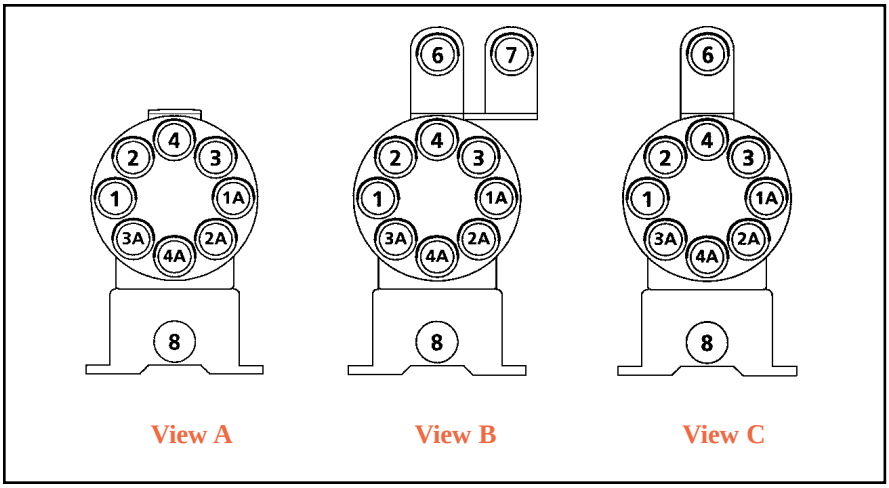
The PL-8 signal uses 18W, 10V, AAR standard signal lamps with SCBC bases. Lamps are precisely positioned on the focal axis for maximum illumination. If a lamp should burn out, the aspect can still be distinguished by color, though not by position.

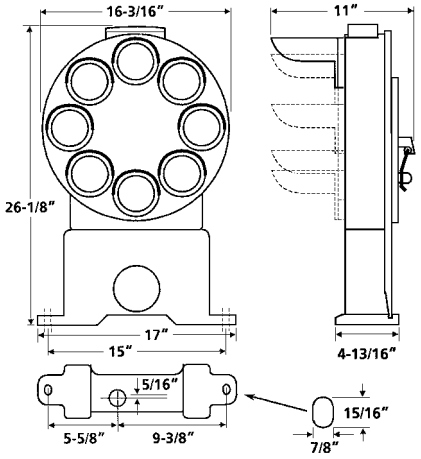
## Ordering Information

- Typical PL-8 units listed in table on next page
- To order other configurations, please specify:
  - Locations of lamps and/or blanking plates in circular array
  - Colors of lamps in circular array
  - Additional lamp color in base section, if required
  - Locations and colors of add-on lamps units on top of main housing, if required
  - Additional K-10 wiring terminal strips
- Key components listed in two tables on next page

## Features

- Ideal for heavily travelled mainline routes
- Precise signaling for heavy duty rail passenger and freight traffic
- Dwarf design for tight mounting spaces
- Numerous aspect options
- Easily installed and serviced




## Complete PL-8 Assemblies

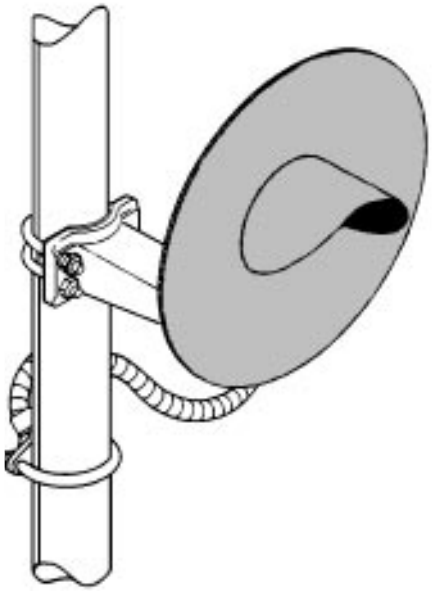
| US&S Order No. | Aspects* | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Above View | 1-1A | 2-2A | 3-3A | 4-4A | 5 | 6 | 7 | 8 |
| N451449-0601 | A | R | LW | Y | G | -- | -- | -- | BP |
| N451449-0603 | A | R | BP | Y | G | -- | -- | -- | BP |
| N451449-0605 | B | R | LW | Y | G | -- | CL | Y | BP |
| N451449-0606 | C | R | LW | Y | G | -- | CL | -- | BP |

R = Red CL = Clear LW = Lunar White
Y = Yellow G = Green BP = Blanking Inside

| US&S Order No. | Description |
|---|---|
| J071463<br>N224372 | Lamp, 18W, 10V S-11<br>Red lens / roundel |

| US&S Order No. | Description |
|---|---|
| N224374<br>N224376 | Yellow lens / roundel<br>Green lens / roundel |

# HC-33 Marker Light



## General

The HC-33 Marker Light Signal is used with color and searchlight signals to provide many different signaling combinations. These standard units are available in a wide choice of color indications, with or without close up prisms, to provide 1-color aspects.

The HC-33 is housed in a rugged and weatherproof aluminum case featuring an easily removed rear door that permits routine access to all internal components such as the lamp and lamp wiring. A lamp unit and a doublet lens make up the optical assembly of the HC-33. This assembly is easily removed from the front of the case as a unit. This signal uses a standard S-11, single contact candelabra base lamp receptacle and a 120 volt, 25 watt lamp. Lamps can be replaced without making any readjustments or altering optical efficiency. Doublet components include a colored back lens and a transparent front lens. This doublet is a special combination of two special stepped lenses that give a considerable angle of divergence, making the signal aspect more effective on curves than could be obtained with conventional lens systems. Light units can be obtained with or without a close up prism.

The HC-33 signal unit is provided with a hood and background. Backgrounds are available in 35" and 20" diameters. Brackets are available for mounting the HC-33 on a standard signal assembly mast. Options include front of mast or side of mast mounting. Front of mast mounting applies only at the top of the mast to allow opening of the signal unit access door. Side mount brackets are adjustable to permit up to 10" deviation, left or right, from the center.

Three standard versions of the HC-33 are available with inclined cover glass and phankill. These items can also be installed on other versions, per customer order. An optional sighting telescope is also available to properly target the signal. This device is temporarily mounted in a threaded hole in the background.

| US&S Order No. | Description | | | | |
|---|---|---|---|---|---|
| | Includes Glass with Phankill | Close-up Prism | Background | Lens | Notes |
| N451359-1101 | Yes | No | -- | Yellow | 1 |
| N451359-1102 | Yes | No | -- | Green | 1 |
| N451359-0406 | No | Yes | 20" | Yellow | -- |
| N451359-0421 | No | Yes | 20" | White | -- |
| N451359-0601 | No | Yes | 35" | Red | -- |
| N15058 | 35" background with hood | | | | |
| N154813 | 20" background with hood | | | | |

Notes 1 - Lamp resistors not available on these units

## Features

- Augments color and searchlight signals
- Wide choice of color indications
- No phantom indications

## Ordering Information

- Common use signals (complete assemblies) and backgrounds listed below.
- Contact US&S Sales to order:
  - Special signal configurations not indicated on this page
  - Adjustable resistor: Options include 1 ohm, 5 ohms, 10 ohms
  - Signal mounting hardware
  - Inclined cover glass with deflection, diffusion or spreadlight prisms
- Refer to page 6I(1) to order standard inclined cover glass and Phankill Screen for HC-33 signals without these items
- Refer to page 6J(1) to order signal lamps
- Refer to page 6K(1) for mainline mast assemblies

## Service Manual Reference

- Refer to US&S **SM 6337**

# Transit Signals - *Units and Assemblies*

## Features

- Designed for all types of transit installations
- Numerous signal head and wayside assembly configurations
- High quality optics, easily located
- Full line of mountings to suit all locations

## Ordering Information

- Typical wall mounted 6-3/8" signal units listed in chart on next page for general pricing purposes
- Typical wayside assemblies (mast mount and dwarf) with 6-3/8" signal head listed on next page
- Contact US&S Sales:
  - When ordering equipment for new transit systems
  - To reorder assemblies or components for 5" lens unit signals
  - To reorder assemblies or components for 6-3/8" signals not listed in this catalog section

## General

US&S offers several complete lines of color light signals suitable for use on all types of rapid transit and light rail lines. These signals are composed of 3-color and 1-color signal units that may be assembled in many different configurations. Some of the signal unit component options include:

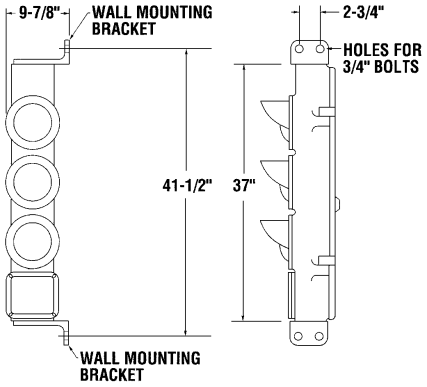
- Choice of lens colors and arrangment
- Blanking plates (when required)
- Signals to display special characters or symbols
- Hoods
- Side and back indication lights
- Transformer or resistor lamp control
- Number plates

Signal heads are available with single 5" lenses or 6-3/8" doublet lenses. The 5" lens signals are typically used in subway installations where space is limited, while the 6-3/8" lens signals are for outdoor service. However, 6-3/8" signals should be used in underground installations when space permits. (Note: This catalog section provides ordering data for 6-3/8" lens signals only. Signals with 5" lenses are readily available from US&S. Contact US&S Sales for complete ordering information.)

The 5" transit signals incorporate glass lenses only, in the standard signaling colors. Lamp receptacle options for these signals include dual medium screw base or dual single contact bayonet candelabra base receptacles. The 6-3/8" signals may be ordered with glass or impact resistant plastic lenses in all standard signaling colors. An inner 5-1/2" lens carries the desired color, while the 6-3/8" outer lens is clear. Lamp receptacle options for the 6-3/8" signal units include single or dual single contact bayonet candelabra base or dual medium screw base receptacles.

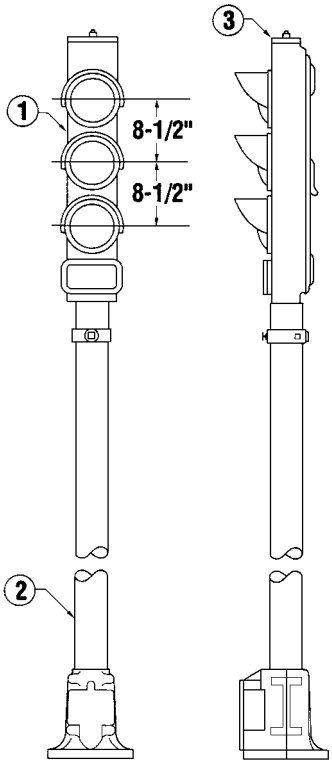
3-color and 1-color signal units are available in several versions, each housed in fully weatherproof aluminum cases with lockable rear doors. The signal units may be joined together in any desired configuration to display any desired aspect. The 3-color units are equipped with integral number plates that can be back-lit, if required. All signals may be equipped with roundels to display special characters or symbols such as arrows, bars or “T”. Transformers or resistors of various types can be mounted directly in the 6-3/8" lens signal cases. Hoodlengths include 4", 7-1/2", or 9".

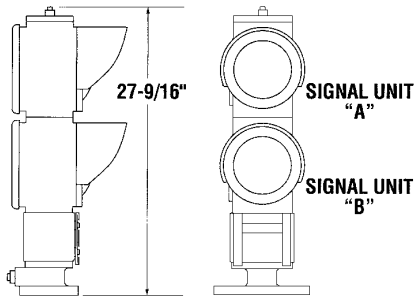
All US&S transit signals can be supplied with components for mounting to tunnel walls or ceilings. They can also be supplied with pipe posts, bases and ladders for stand alone mounting. Bases for dwarf signal installations are also available.




## Typical Wall Mounted Signal Head

| US&S Order No. | Description |
|---|---|
| N451625-2602 | Single unit, 3-color transit signal (G/Y/R) |




## Dwarf Transit Signal

| US&S Order No. | Description |
|---|---|
| N451625-1101 | 2-unit dwarf signal (yellow / red) |

## Mast Mounted Transit Signal Assembly

| US&S Order No. | Description |
|---|---|
| N451625-2602 | Single unit, 3-color transit signal (G/Y/R) |

## Mast Mounted Transit Signal Assembly Key Components

| US&S Order No. | Ref. | Description |
|---|---|---|
| N451162-6005 | 1 | Signal head (red / yellow / blank) |
| N451162-6003 | 1 | Signal head (red / yellow / green) |
| N434390-007 | 2 | Mast, with base |
| M436246 | 3 | End cover |

NOTE Contact US&S to order fastener hardware

UNION SWITCH & SIGNAL

6H(1)
Rev. 5/97

# Multi-Purpose Modular Color Light Signals

## Features

- Excellent long range indication
- Modular design
- Adjustable tilt base
- Total adjustability for accurate field alignment

## Ordering Information

- Order complete signal assemblies from table on next page
- Contact US&S Sales to order replacement parts or any special aspect configurations not listed in the table on next page

## General

US&S's multi-purpose modular color light signals combine high quality construction with a highly adaptable design. These modular signals can be stacked with two, three or four signal units as required by the application. The individual signal units feature a large compartment for ease of access to electrical and optical components. Each compartment incorporates a door with a pad-locking hasp. Optics are factory pre-focused and use high impact color lenses. Signal indications can be easily seen over long distances, even in bright daylight. An optional anti-phantom screen is available for each lens assembly to prevent unwanted secondary reflections.

The mainline signal assembly can be mounted on top of the mast or on the front side with a special side of mast mounting bracket.

The dwarf signal assembly can be ordered with a fixed angle of tilt up to 7 degrees. Adjusters are provided on both the mainline and dwarf signals for all aiming angles, allowing fast and precise alignment in the field. Cast aluminum construction is used throughout to minimize weight and prevent corrosion.

## Specifications

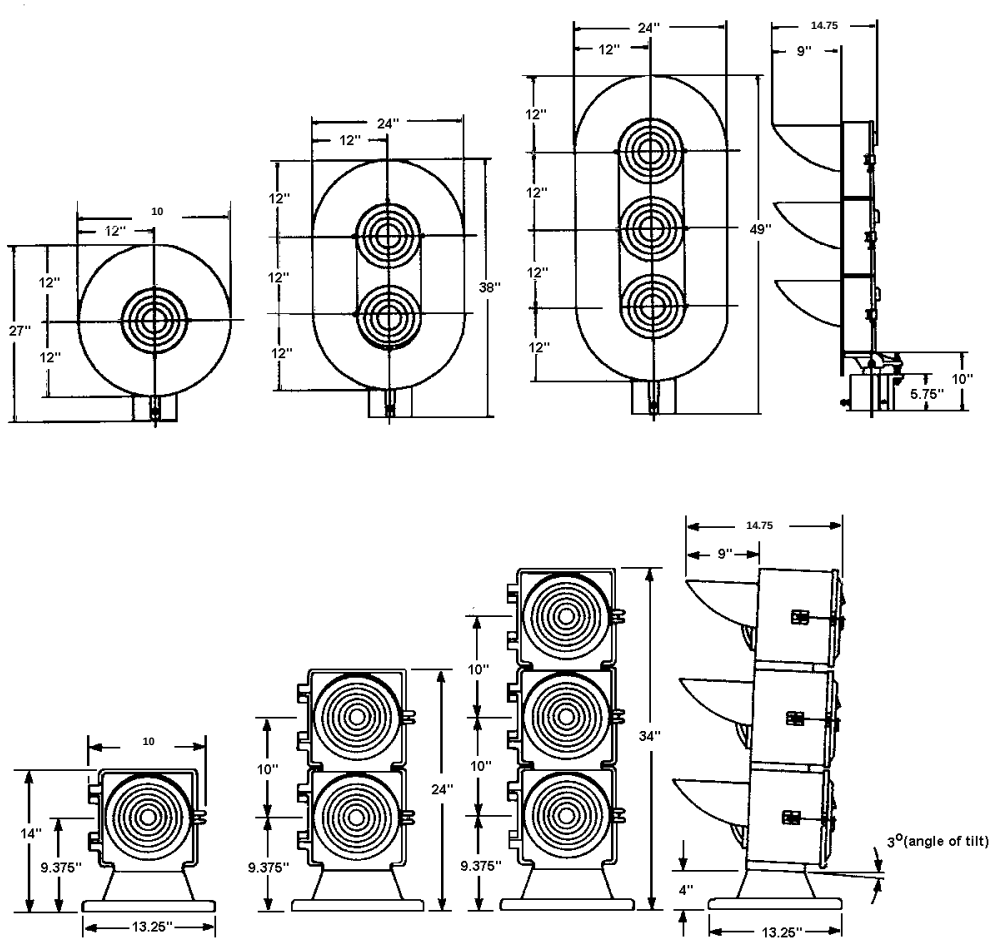
| | |
|---|---|
| ***Signal Unit Options*** | *Mainline and Dwarf*: From 1 to 4 units |
| ***Lens Color Options*** | *Mainline and Dwarf*: Red, yellow, green, lunar white |
| ***Lens Arrangement*** | *High*: 8-3/8" outer; 5-1/2" inner<br>*Dwarf*: Doublet - 6-3/8" outer; 5-1/2" inner |
| ***Lamp Sockets*** | *Mainline and Dwarf*: Standards single-contact, 2-pin bayonet |
| ***Top-of-Mast Mounting*** | *Mainline*: for 5" masts (4" adapter available) |
| ***Side-of-Mast Mounting*** | *Mainline*: for 5" masts; see ordering table |
| ***Angle of Tilt*** | *Dwarf*: 0 to 7 degrees |
| ***Unit Dimensions*** | See illustrations on next page |

| US&S Order No. | Description | Notes |
|---|---|---|
| N451915-0173 | 1-Aspect Mainline Signal | 1 |
| N451915-3241 | 2-Aspect Mainline Signal | 2 |
| N451915-1331 | 3-Aspect Mainline Signal | 3 |
| N451915-1351 | 3-Aspect Mainline Signal | 4 |
| N451915-1352 | 3-Aspect Mainline Signal | 5 |
| N451915-1441 | 4-Aspect Mainline Signal | 6 |
| N451912-0173 | 1-Aspect Dwarf Signal | 7 |
| N451912-0221 | 2-Aspect Dwarf Signal | 8 |
| N451912-0262 | 2-Aspect Dwarf Signal | 9 |
| N451912-0304 | 3-Aspect Dwarf Signal | 10 |
| N451912-0401 | 4-Aspect Dwarf Signal | 11 |
| N451912-1351 | 3-Aspect Mainline Signal | 4 |
| N451916-0301 | Swivel Base Assy (5” mast) | |
| N451913-0502 | Swivel Base Assy (ground mounted) | |

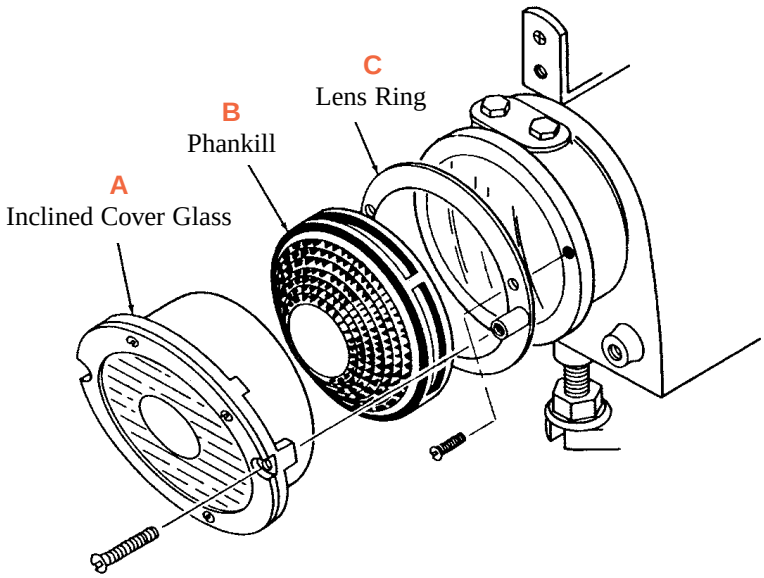
Notes

1 Aspect: Red
2 Aspects: Red-Yellow*
3 Aspects: Red-Green-Yellow*, with resistors
4 Aspects: Red-Green-Yellow*, with transformers
5 Aspects: Green-Red-Yellow*
6 Aspects: Red-Green-Yellow-Lunar White*
7 Aspect: Yellow
8 Aspects: Red-Lunar White*
9 Aspects: Red-Green*
10 Aspects: Red-Lunar White-Yellow
11 Aspects: Red-Green-Yellow-Lunar White*

*Top-to-bottom order of lenses



# Inclined Cover Glass Assemblies and Phankill Units




## Features

- Maximum performance from signal optics
- Installs on many different types of signals

## Ordering Information

- Order basic inclined cover glass assemblies with clear roundels and without Phankill units from the first of three tables on the next page
- Commonly used inclined cover glass assembly with Phankill unit and separate Phankill unit listed in second tabulation. This assembly is intended for US&S color light signals and searchlight signals (except the “H”). It isn’t used on the HC-33 signal.
- Separate roundels listed in third table
- Contact US&S Sales to order special assemblies or hardware not listed in the tables on the next page

## General

US&S’s inclined cover glass assembly modifies the beam pattern of signal lamps to obtain optimum deflection and diffusion patterns. These patterns help accommodate each signal installation to variations in track curvature and local topography. The inclined cover glass is designed for the 8-1/8" diameter lens units used in US&S searchlight signals (high and dwarf), marker lights and color lights.

Components of the assembly include the adapter ring, clear roundel and lens ring. The roundel is held in position in the adapter ring by the lens ring and three screws. A gasket between these rings provides a water-tight seal, while a second gasket cemented to the rear of the adapter ring provides another water seal between the inclined cover glass and the signal unit.

A wide assortment of roundels is used in these assemblies to provide the required deflection and spreadlight or diffusion characteristics. While the basic inclined glass assembly minimizes phantom effects, optional Phankill units may be ordered to further reduce these effects. The phankill is attached with a lens ring and three mounting screws.

## Inclined Cover Glass Assemblies without Phankill

| US&S Order No. | Description | | | | | |
|---|---|---|---|---|---|---|
| | Ref. | Type | Deflect. Angle | Deflect. Direct | Spreadlight | Notes |
| N184403 | A | Flat, clear | 10º | Left | -- | -- |
| N184404 | A1 | Flat, clear | 20º | Left | -- | -- |
| N184405 | A2 | Flat, clear | 30º | -- | 15ºL & 15ºR | -- |
| N220829 | A3 | Flat, clear, plain | -- | -- | -- | -- |
| N240656 | A4 | Flat, clear | 10º | Up | -- | 1 |
| N391732 | A6 | (Without roundel) | -- | -- | -- | -- |

Notes 1 - With painted risers; assemblies with prisms removed for searchlight dwarf signals

## Inclined Cover Glass Assemblies with Phankill and Phankill Unit Only

| US&S Order No. | Description |
|---|---|
| X388096 | Inclined cover glass assembly with Phankill unit. Includes roundel, adapter, Phankill, lens ring, assembly hardware. Roundel: flat, plain, clear, no spreadlight. |
| N143504 | Phankill unit only. |

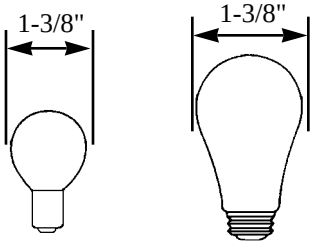
## Roundels

| US&S Order No. | Description | | | | |
|---|---|---|---|---|---|
| | Type | Deflect. Angle | Deflect. Direct | Spreadlight | Notes |
| N222600 | Flat, clear | 10º | Left | -- | -- |
| N199883 | Flat, clear | 20º | Left | -- | -- |
| N216441 | Flat, clear | 30º | -- | 15ºL & 15ºR | -- |
| N256211 | Flat, clear | 10º | Up | -- | 2 |
| N437954 | Lexan® clear, flat, plain | -- | -- | -- | -- |

Notes 1 - With painted risers; assembly with prisms removed for searchlight dwarf signals

# Lamps

## Bulb Styles




Style A  Style B

## Features

- Lamps service color, search, marker, and position lights
- High quality, AAR-specified

## Ordering Information

- Order signal lamps according to specifications in table below
- Contact US&S to order special purpose lamps not listed

## General

US&S stocks a complete line of incandescent lamps, including quartz iodine, for railroad and transit signal lights. These lamps are built to exacting specifications and help yield maximum performance from signal unit optical systems. A wide variety of filament, base and bulb configurations are available to satisfy most signal requirements.

## Bases

Lamp base options include bayonet, rebased and screw types. Bayonet and rebased lamps contain precisely formed filaments that are installed in the lamp base so that the filament is always situated at the exact focal point of the signal's lens system. Screw base lamps are used where precision optical alignment is not required, for example, in short range signals and marker lights.

Bayonet-base lamps contain a bulb and a filament unit with a 2-pin base accurately attached to the light center length and axial alignment. The rebased lamp is similar to the bayonet base type, but with a rebasing sleeve in place of the pins. Lamp base contact arrangements include single contact (SC) and double contact (DC). On the single contact unit, connections are made to the base and single single contact. For the double contact unit, connections are made to each of the contacts, each of which is independent of the base.

## Filaments

Signal lamps incorporate single or double filaments. Filament life of the single filament lamps depends on the applied voltage. These types of lamps are replaced when the expected maximum operating life (indicated n hours) is exceeded.

If a filament burns out in a double filament lamp, the bulb will remain lit on the remaining filament. These lamps are replaced when visual inspection reveal the first burned out filament.

Special double filament lamps are available with an extended duration secondary filament. This filament produces a somewhat fainter glow; when the primary filament burns out, the reduced glow of the secondary filament is evident. This helps mark the bulb for replacement.

## Specifications

| | | |
|---|---|---|
| ***Bulb Symbols*** | S | Shape (see illus. at top of page) |
| | A | Shape (see illus. at top of page) |
| | S-X, A-X | X = diameter in 1/8" |
| ***Filament Symbols*** | S | Straight |
| | C | Coiled |
| | CC | Coiled Coil |
| | R | Rounded |
| | V | V-shaped |
| | MF | Main Filament |
| | SF | Secondary Filament |
| ***Base Symbols*** | 2-PS | 2-pin rebased sleeve |
| | SC | Single Contact |
| | SCBC | Bayonet |
| ***LCL*** | Light center length.<br>*Bayonet and rebased lamps*: Distance from center of light source to top of pins<br>*Screw base lamps*: Distance from center of light source to bottom of base contact (excl. solder) | |

| US&S Order No. | Description | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Application | AAR Item No. | Volts | Amp/Watt CP | Bulb Style | LCL | Base | Filament(s) Types | Life Hrs. |
| J714166 | Color light signal (CLT) | 96 | 10 | 18W+3.5W | A-15 | 2-7/32 | 2-PS | MF:CC-6, SF:CC-66 | 1500 |
| J071463 | " | 88 | 10 | 18W | S-11 | 1-1/4 | SCBC | CC-6 | 1000 |
| J071656 | " | 67 | 10 | 13W+3.5W | S-11 | 1-1/4 | SCBC | CC-6, SF:C-12 | 1000 |
| J071574 | " | 100 | 10 | 25W | S-11 | 1-1/4 | SCBC | CC-6 | 1000 |
| J071613 | " | 72 | 11 | 11W | S-11 | 1-1/4 | SCBC | C-2V | 2500 |
| J071685 | Lever light (LL) | 49 | 120 | 10W | S-11 | 1-1/4 | SCBC | C-7A | 1500 |
| J071656 | Searchlight signal (SLT) | 67 | 10 | 13W+3.5W | S-11 | 1-1/4 | SCBC | MF:CC-6V, SF:C-12 | 1000 |
| J071463 | " | 88 | 10 | 18W | S-11 | 1-1/4 | SC | CC-6 | 1000 |
| J071574 | " | 100 | 10 | 25W | S-11 | 1-1/4 | SCBC | CC-6 | 1000 |
| J071613 | " | 72 | 11 | 11W | S-11 | 1-1/4 | SCBC | C-2V | 2500 |
| J071463 | Position light (PLT) | 88 | 10 | 18W | S-11 | 1-1/4 | SCBC | CC-6 | 1000 |

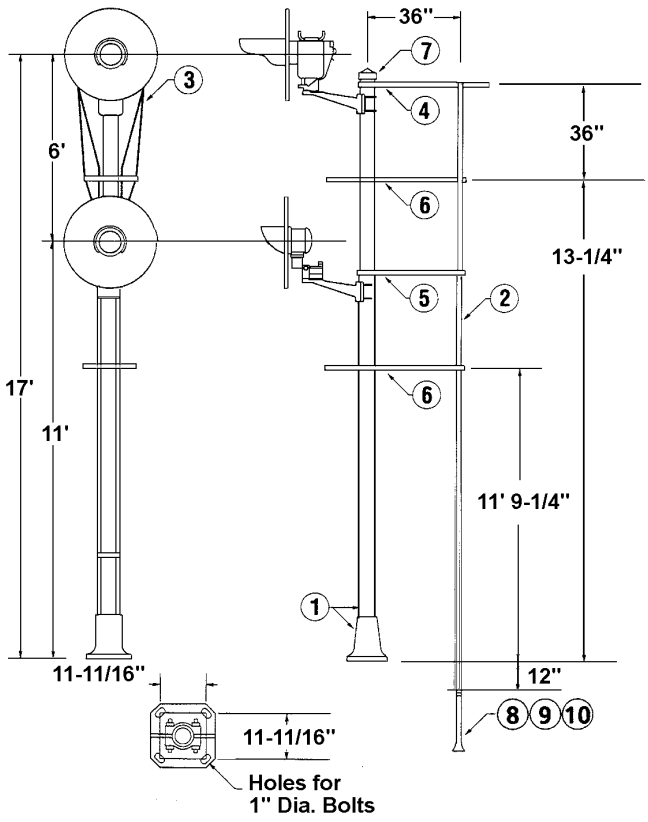
# Mainline Signal Assemblies

## General

Signal assemblies using US&S's H-2 searchlight signal and/or HC-33 marker light are well suited for most mainline applications. These assemblies are available in various heights with up to three separate signal units. All components are factory drilled and fitted for easy erection in the field, and all assemblies comply with AAR and state regulations. Component selections include 5 or 6 inch diameter masts of steel or aluminum, mast pinnacle, gal-vanized steel ladders, platforms, hand rail ladder stays, foundation piers for ladders, and regular or electrical junction box bases. US&S can custom design mainline assemblies to the most exacting customer specifications.

## 2-Signal Assembly, 17 Ft.

| US&S Order Number | Ref. | Description |
|---|---|---|
| N451394-5902 | 1 | Mast, 5" aluminum, 16 ft. |
| N451192-4104 | 2 | Ladder subassembly |
| N116624-002 | 3 | Brace assembly, ladder |
| N377650 | 4 | Handrail assembly, top |
| N377653 | 5 | Handrail assembly |
| N451438-2901 | 6 | Platform, with ext. 5" pipe |
| J705192-0001 | 7 | 5" pipe pinnacle |
| M062563 | 8 | Pier, foundation |
| J466071-0124 | 9 | Bolt, 1/2 x 1-1/2 sq. hd. galv. |
| J480210-0105 | 10 | Nut, 1/2-13 hex., galv. |

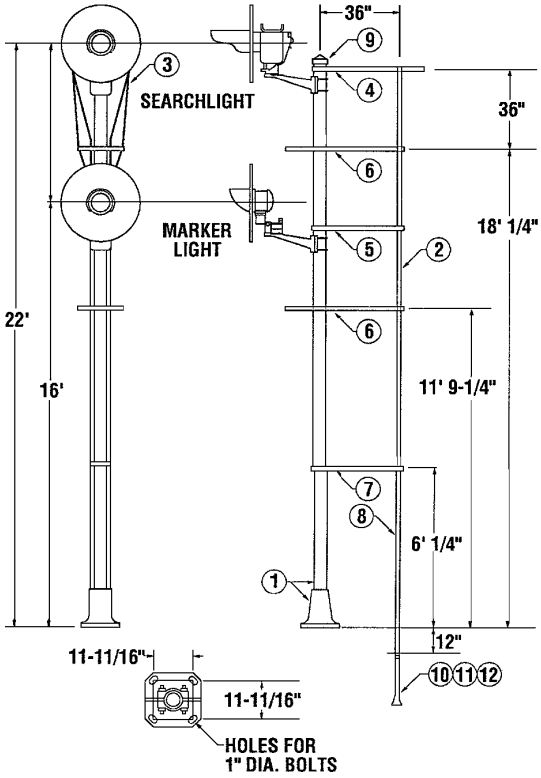


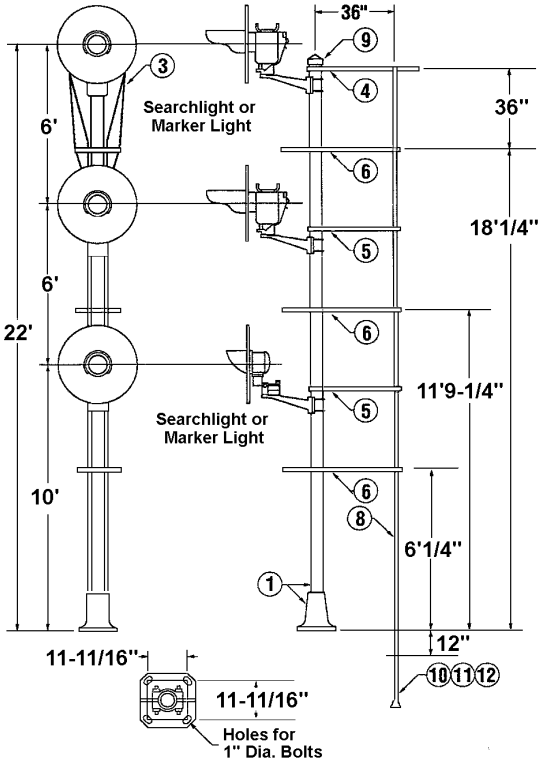

## Features

- Searchlight/marker light installations
- Two or three signal assemblies
- Full compliment of mast components

## Ordering Information

- Commonly used searchlight/marker light kits and kit components listed on this page and on page 6K(2).
- Contact US&S Sales to order:
  - Special searchlight/marker assemblies
  - Mainline color light/marker light signal assemblies
  - Electrical junction box bases




## 2 and 3-Signal Assemblies, 22 Ft.

| US&S Order Number | Ref. | Description |
|---|---|---|
| X451193-3902 | -- | Assembly kit for 2-unit signal |
| X451193-3901 | -- | Assembly kit for 3-unit signal |
| N451394-5901 | 1 | Mast, 5" aluminum, 21 ft. |
| N451192-4104 | 2 | Ladder subassembly |
| N116624-002 | 3 | Brace assembly, ladder |
| N377650 | 4 | Handrail assembly, top |
| N377653 | 5 | Handrail assembly |
| N451438-2901 | 6 | Platform, with ext. 5" pipe |
| N128591 | 7 | Stay assembly, ladder |
| N377874 | 8 | Ladder assembly |
| J705192-0001 | 9 | Pinnacle, 5" pipe |
| M062563 | 10 | Pier foundation |
| J466071-0124 | 11 | Bolt, 1/2 x 1-1/2 sq. hd. galv. |
| J480210-0105 | 12 | Nut, 1/2-13 hex., galv. |

# FR-HI Shunt

## Features

- Suitable for Short Detector Track Circuits
- High Inter-Rail Voltage to reduce Shunting Problems (6-35 V AC)
- Current Draw 1.3 A

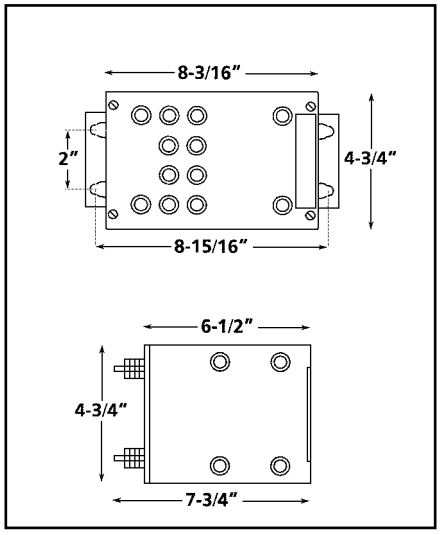
## Ordering Information

- FR-HI Shunt unit, adjustable resistor for PN-150BQS track relay listed below
- Refer to page 8F(1) to order PN-150BQS relay N322501-703

## Service Manual Reference

- Refer to **SM 5966**

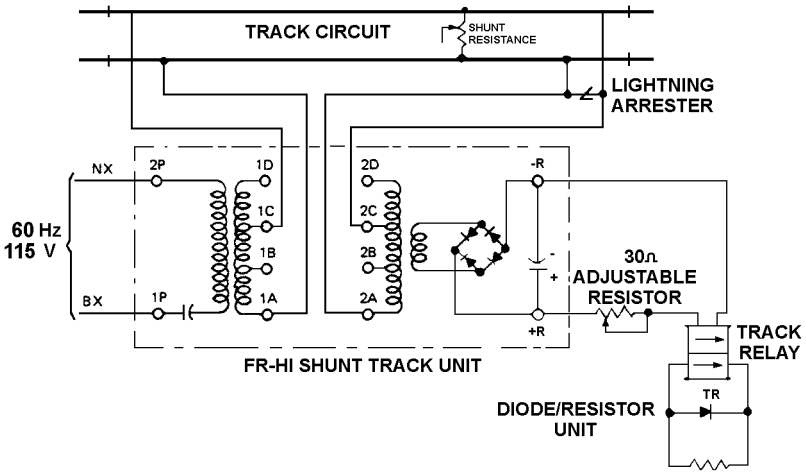
| US&S Order No. | Description |
|---|---|
| N375927<br>N156685 | FR-HI Shunt Track Unit Adjust. resistor, 30 ohm |




## General

The FR-HI Shunt Track Circuit overcomes shunting difficulties due to oily, dirty rail and wheel film, when used in short detector track circuits. It also provides unusually high inter-rail voltage for quickly breaking through rail film, and provides protection against momentary loss of shunt.

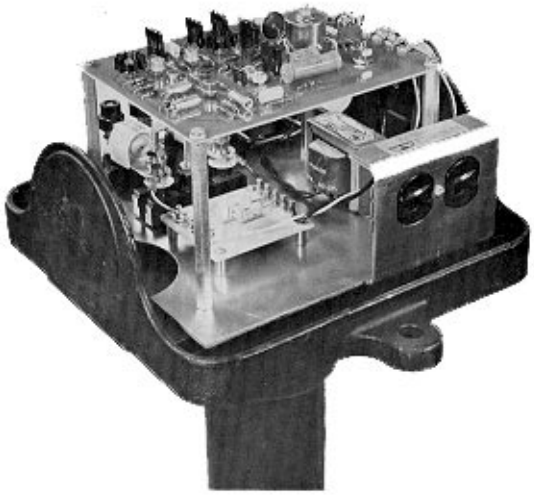
Short detector track circuits, where the total ballast is at least 8 ohms, are particularly well served by the FR-HI Shunt unit. The degree of defective insulated rail joint detection is similar to that of other types of AC or AC/DC track circuits. Although typically used in classification yards, the FR-HI Shunt Track Circuit may also be used for other short detector track circuit applications where a high degree of shunting sensitivity is required. Additional features of the unit include low power requirements, simple installation and adjustment, and minimum maintenance.



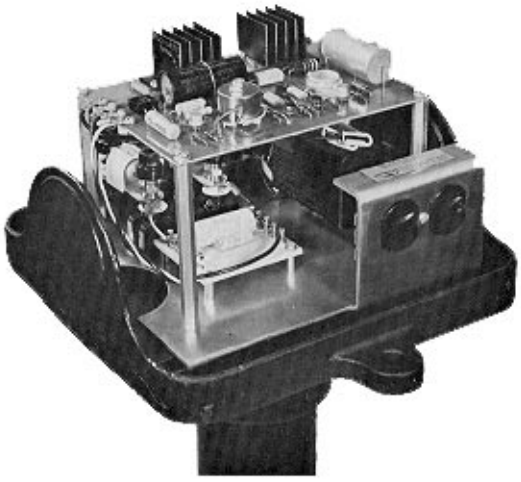
UNION SWITCH & SIGNAL

7B(1)
Rev. 5/97

# High Frequency Track Circuit



*Receiver Assembly*



*Transmitter Assembly*

## Features

- Ideal for Classification Yards
- Provides Switch Locking Protection without Insulated Joints
- High Intensity - Useful with Heavy Rail Film

## Ordering Information

- Standard Transmitter and Receiver assemblies information can be found in tables on next page
- Order equipment with or without pedestal mounting
- Contact US&S Sales to order appropriate track relay for High Frequency track circuit

## Service Manual Reference

- Refer to **SM 5865**

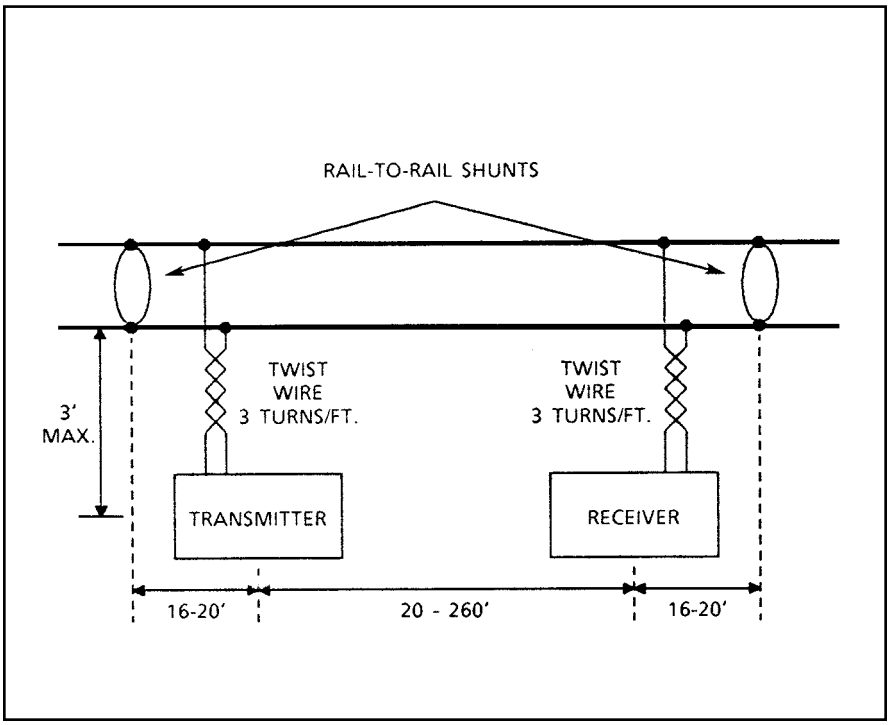
## General

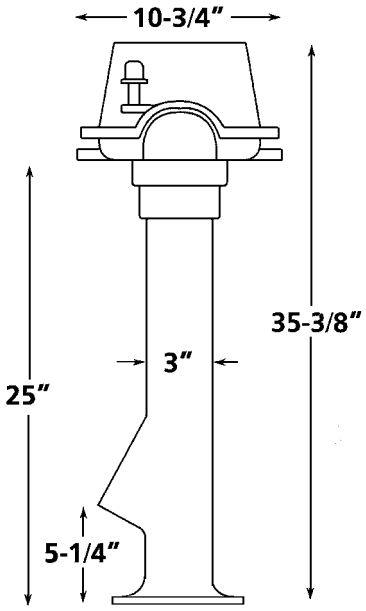
US&S's High Frequency track circuit equipment is designed for short track circuit installations such as those in classification yards. The equipment consists of a transmitter and a receiver connected between two rail to rail shunts, which define the limits of the track circuit.

Four frequencies are available to insure compatibility of adjacent track circuits without interference. These include 46.5, 57.0, 71.5, and 89.0 KHz. In applications where two track circuits are connected in sequence, the low end and high end frequencies (46.5 and 89.0 KHz) must be used.

The track circuit equipment may be used in series along a section of track and may encompass single switches or LAP switches. Because these track circuits are short, ballast condition is not critical. The High Frequency Track circuit is highly sensitive and therefore useful where a high degree of rail film is present. Track lengths from 60 to 300 feet can be serviced by this equipment.

Transmitter and receiver units are each housed in a waterproof, pedestal mounted junction box. Unit may be ordered without the pedestal. The complete assemblies are mounted near the rails (maximum 3 ft. from the nearest rail). The equipment is fully solid-state and operates from 117 volt, 60 Hz power.




## Transmitter

| US&S Order No. | Description | |
|---|---|---|
| | Freq. (KHz) | Pedestal |
| X451147-0135 | 46.5 | X |
| X451147-0139 | 57.0 | X |
| X451147-0143 | 71.5 | X |
| X451147-0103 | 46.5 | -- |
| X451147-0107 | 57.0 | -- |
| X451147-0111 | 71.5 | -- |
| X451147-0115 | 89.0 | -- |
| X451147-0147 | 89.0 | X |

## Receiver

| US&S Order No. | Description | |
|---|---|---|
| | Freq. (KHz) | Pedestal |
| X451147-0133 | 46.5 | X |
| X451147-0137 | 57.0 | X |
| X451147-0141 | 71.5 | X |
| X451147-0101 | 46.5 | -- |
| X451147-0105 | 57.0 | -- |
| X451147-0109 | 71.5 | -- |
| X451147-0113 | 89.0 | X |
| X451147-0145 | 89.0 | X |

UNION SWITCH & SIGNAL

7C(1)
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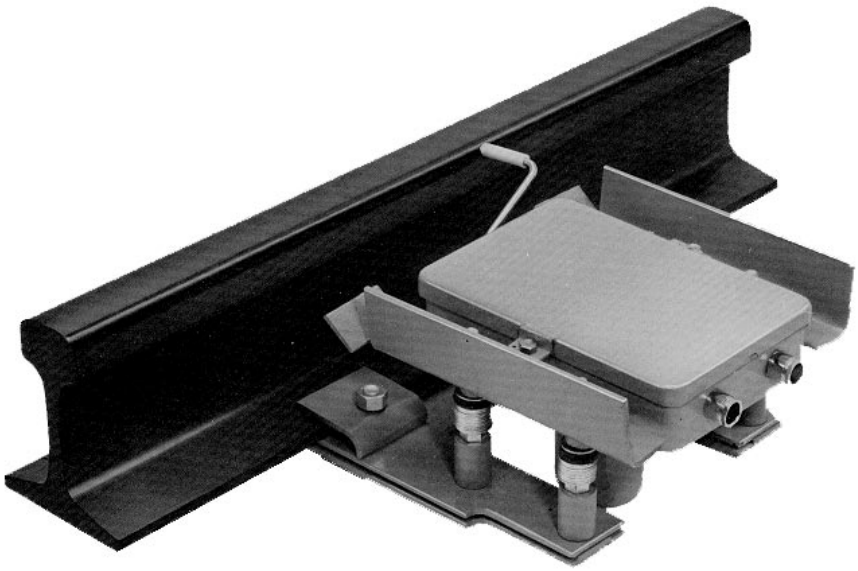
# Mechanical Wheel Detector



## Features

- Reads passing wheels up to 150 mph
- Bi-directional or non-directional models

## Ordering Information

- Standard order numbers for Mechanical Wheel Detector models and arm time delay unit fluid listed below
- Detector mounting base ordered separately

The Mechanical Wheel Detector provides consistent indication of railroad wheel passage. Non-directional or bi-directional models are available for:

- Track circuits with bad shunting
- Highway crossing circuits
- Check-in/ check-out circuits
- Release of electric lock
- Speed measurement
- Way scale, hot box detector start
- Yards: Track fullness, wheel count

This wheel detector is housed in a rugged cast-iron housing and incorporates corrosion proofed components.

The unit is mounted to the rail base with clamps; no web drilling is required. Wheel detection is obtained through one (non-directional) or two (bi-directional) mechanical detector arms actuated by the wheel flange.

An adjustable arm delay is standard with the bi-directional unit and optional with the non-directional unit. The arm is linked to a torsion shaft with a shock absorber and operates two sets of front/back dependent electrical contacts. AAR terminals are provided for all electrical connections.

## Specifications

| | |
|---|---|
| ***Operating Time*** | 0.003 sec. (min.) |
| ***Contact Type*** | Silver to silver |
| ***Contact Rating*** | 4.0 A, non-inductive |

| US&S Order No. | Description |
|---|---|
| 98265005 | Non-directional wheel detector w/adjustable arm return delay |
| 98265016 | Non-directional wheel detector w/out adjustable arm return delay |
| 88255016 | Bi-directional wheel detector w/adjustable return arm delay |
| 88265005 | Wheel detector mounting base |
| 13005019 | Fluid for adjustable time delay unit (Qty = 1 pint) |

UNION SWITCH & SIGNAL

7D(1)
Rev. 1/99

# ACCUTECT® Wheel Detector

ACCUTECT is an advanced, solid-state device that yields highly consistent wheel indications. The unit is a component of a system, consisting of a detector head, mounting hardware, an office installed signal processing printed circuit board and interconnecting cabling. A direct replacement for US&S's older WD-30D wheel detector, ACCUTECT can be used in classification yards or along main traffic routes and senses wheel passage as high as 125 miles per hour. If a wheel parks over the detector head, the signal output times out. No field electronics or recalibrations are required for the ACCUTECT wheel detector.

ACCUTECT can be mounted with clamps that attach to the base of the rail, or by bolting directly to the web. The improved clamps feature heavy-duty hooks with a deep "V" profile that grips more than twice as much of the rail base as previous clamps. These clamps also allow installation of ACCUTECT on all sizes of rail. Existing WD-30D rail mounting holes can also be used to mount ACCUTECT. The clamp-to-angle head mounting on ACCUTECT allows removal of the detector without removal of the clamp assembly from the rail. Stainless steel mounting bolts are used to minimize corrosion. The field signal cable is attached to the unit with a water-tight connection.
Retrofit of the WD-30D detector with ACCUTECT does not require changes in the office electronics, and the field electronics in the WD junction box can be eliminated. However, a wiring junction box may be required for field termination. Or, cables may be terminated with an underground splice. Direction-of-travel sensing may be handled by applying three ACCUTECT units in a single system.

## Features

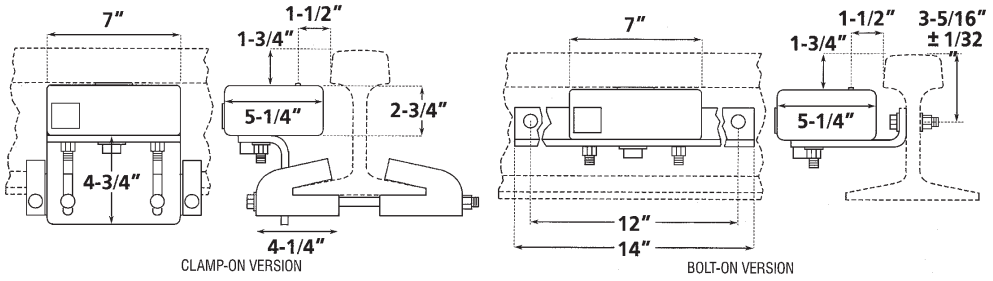
- Wheel detection at vehicle speeds up to 125 mph
- No field adjustment required
- Clamp-on kit simplifies installation
- Vibration improved connector assembly and improved sensor shield

## Ordering Information

- Standard detector and mounting kits listed on next page
- Most commonly used interface cables listed in tabulation on next page. Other lengths available
- Contact US&S Sales to order:
  - Power and interface PCBs
- Refer to service manual for complete parts listing

## Service Manual Reference

- Refer to **SM 6324**



## Specifications

***Input Voltage*** 24 Vdc (nom.)

***Output Voltage*** Low level: 0 volts
High level: 7 Khz

***Breakdown Rating*** 3000 volts: Between detector electronics and rail

## ACCUTECT Detector Kits

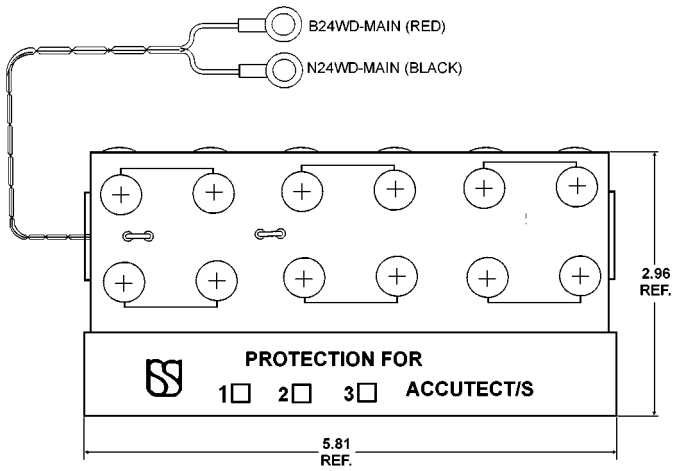
| US&S Order Number | Description | Notes |
|---|---|---|
| X451062-6601 | Detector head, clamp assembly, angle head, and hardware | 1 |
| X451062-6602 | Clamp assembly | 2 |
| X451062-5201 | Bolt-on detector kit, with electronics (1/2" bolts) | 3 |
| X451062-5203 | Bolt-on detector kit, with electronics (3/8" bolts) | 4 |
| N451062-4901 | Wheel detector head only | -- |

**NOTES**
1- Complete clamp-on kit (replaces old clamp-on kit X451062-5101)
2- Old-to-new clamp retrofit kit (detector head not included)
3- For 1/2" mounting bolts (through rail)
4- For 3/8" mounting bolts (through rail). Direct replacement for WD-30

## Common Use Interface Cables

| US&S Order Number | Description |
|---|---|
| N451458-4805 | 15' foot common use interface cable |
| N451458-4806 | 20' foot common use interface cable |
| N451458-4807 | 25' foot common use interface cable |

# ACCUTECT® Lightning Protection Networks




## Features

- Protects 1, 2, or 3 Accutect Wheel Detectors from damage associated with lightning.
- Easily mounted in wayside junction box
- Easy to replace printed circuit board assembly if necessary

## Service Manual Reference

- Refer to **SM 6486**

The ACCUTECT Lightning Protection Network is a self-contained lightning protection unit that can protect 1, 2, or 3 ACCUTECT Wheel Detectors from damage associated with lightning. The assembly consists of a 12-way AAR terminal block, a steel mounting plate, a printed circuit board assembly, and all the hardware necessary for wiring and mounting the unit to a wayside junction box. Once these assemblies are installed, the terminal block and steel plate should never require replacement under normal service conditions. The printed circuit board assembly is easily replaceable if necessary and can be ordered from the tabulation below.

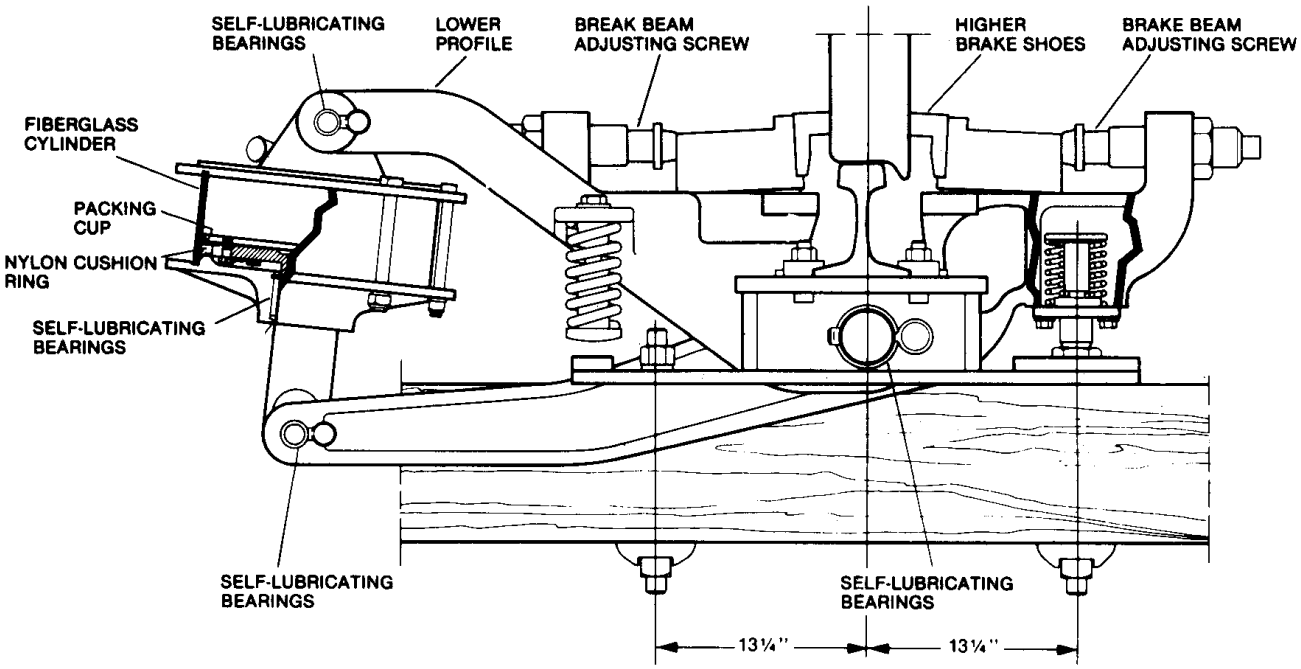
## ACCUTECT Lightning Protection Networks

| US&S Order Number | Description |
|---|---|
| N352001-01 | Protects 1 ACCUTECT Wheel Detector |
| N352001-02 | Protects 2 ACCUTECT Wheel Detectors |
| N352001-03 | Protects 3 ACCUTECT Wheel Detectors |

## ACCUTECT Lightning Protection Replacement Boards

| US&S Order Number | Description |
|---|---|
| N353001-01 | Printed circuit board assembly (only) protects 1 ACCUTECT Wheel Detector |
| N353001-02 | Printed circuit board assembly (only) protects 2 ACCUTECT Wheel Detectors |
| N353001-03 | Printed circuit board assembly (only) protects 3 ACCUTECT Wheel Detectors |

# Model 81 Retarder




## Ordering Information

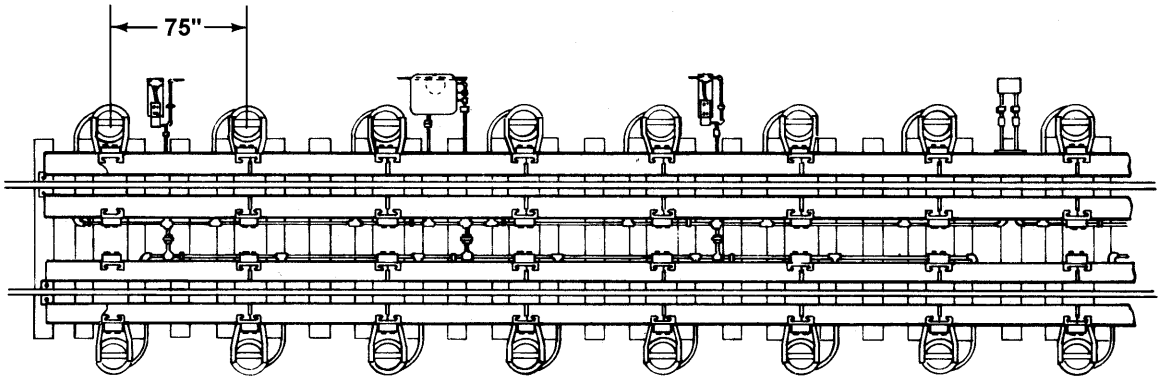
This section lists key service components of the US&S Model 81 Electro-Pneumatic car retarder referenced to Service Manual SM 6256. Items listed in the tabulation on this page represent components most frequently ordered for routine maintenance of the retarder. To order other Model 81 components or obtain general information on the complete retarder system, contact US&S Sales.

## Service Manual Reference

- Refer to **SM 6256**

| US&S Order Number | Description |
|---|---|
| M451610-0202 | Beam, left-hand end brake |
| M451610-0302 | Beam, right-hand end brake |
| J027329 | Brake shoe, left-hand tapered |
| J027330 | Brake shoe, right-hand tapered |
| J027331 | Brake shoe, long |
| J027332 | Brake shoe, short |
| J466075-0101 | Bolt, 7/8 X 4, Brake Shoe |
| J480267 | Locknut, 7/8 - 9 hex, Brake Shoe |
| J067414 | Cylinder Packing 12" |
| J067440-0101 | Cylinder Packing 14" |

# Model 32/67 Remanufactured Retarder




## Model 32/67 Main Assembly

| US&S Order Number | Description |
|---|---|
| J466075-0101 | Bolt, brake shoe 7/8 X 4 |
| J480267 | Locknut, 7/8 - 9 hex, Brake Shoe |
| J792581-019 | Beam, intermediate brake |
| J027331 | Brake shoe, long |
| J027332 | Brake shoe, short |
| J027329 | Brake shoe, left-hand end brake |
| J027330 | Brake shoe, right-hand end brake |
| J792581-005 | Beam, right-hand, end brake |
| J792581-051 | Beam, left-hand, end brake |
| J792581-023 | Bolt, thrust block |

### Ordering Information

This section lists key service components of the US&S Model 32/67 Electro-Pneumatic car retarder. Items listed represent components most frequently ordered for routine maintenance of the retarder. To order other Model 32/67 components contact US&S Sales.

### Service Manual Reference

- Refer to **SM 5313**

## Model 32/67 Cylinder

| US&S Order Number | Description |
|---|---|
| J067440-0101 | Cylinder packing 14 1/2" |
| J067414 | Cylinder packing 12" |

# Type IV Weigh Rail

## Features

- Measures all four standard weight ranges
- Easily installed, fully adjustable

## Ordering Information

- Standard weigh rail order numbers listed in tabulation below
- When ordering, please indicate applicable rail weight

## Service Manual Reference

- Refer to **SM 5793**

The US&S Type IV Weigh Rail is used in automatic classification yards to determine weight ranges of cars awaiting movement into the yard. It is a durable device capable of registering all standard weight classes, including light (14 to 35 tons), medium (35 to 52 tons), heavy (52 to 110 tons) or extra heavy (110 tons and over). All units contain a heater.

Weight exerted by a passing car is sensed by a lever within the main section of the assembly. A controller box, attached to the weigh rail generates weight readings for processing by the yard control system. The control box contains a mechanism with four contacts which are adjusted to indicate light, medium, heavy or extra-heavy cars.

The Type IV weigh rail is designed to bolt directly to 140# R.E. rail, but can be fitted to any standard size rail by using compromise joints.

Recommended installation is in a straight, even graded track section at least 25 ft. from any track curvature. Concrete or well-tamped ballast may be used as a foundation.

| US&S Order Number | Description |
|---|---|
| N451059-0201 | Type IV Weigh Rail with 24 volt heater (Weigh rail drilled for joint bar) |
| N451059-0208 | Type IV Weigh Rail with 24 volt heater (Weigh rail not drilled) |

# DU-1 Pressure Regulator

The US&S type DU-1 pressure regulator is used in automatic classification yards with US&S style electro-pneumatic retarders. The purpose of the differential unit is to equalize the air pressure in any two adjoining retarder sections.

Equalization of the air pressure assures a smooth transition as the car travels into the adjacent section. This differential unit design consists of two bourdon tubes reacting to a minimum differential pressure of 5 psi.

| US&S Order No. | Description |
|---|---|
| N344021 | DU-1 pressure regulator for retarders |

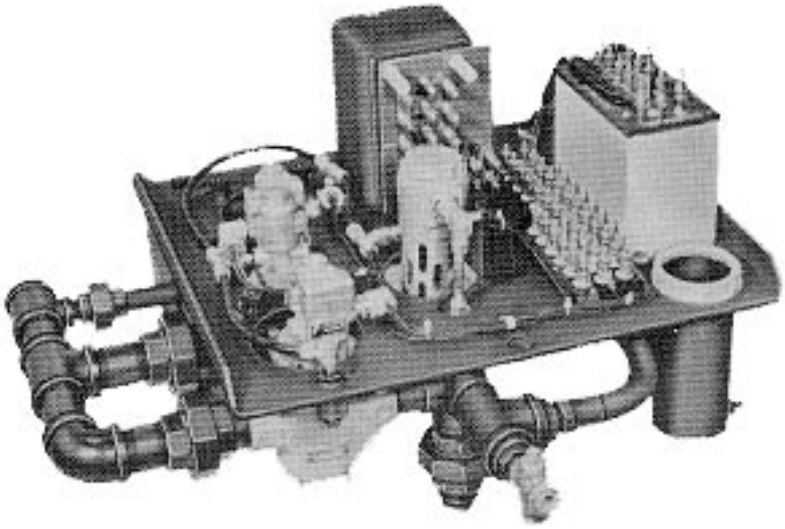
## Features

- Assures smooth car transition through retarder
- Services most US&S retarders
- Operable by any type of yard control system

## Ordering Information

- Standard order number for DU-1 Pressure Regulator listed below
- Contact US&S Sales to order replacement components

# HS-2 Retarder Control Valve



The HS-2 Retarder control valve is a solenoid actuated, high speed device for controlling air pressure in electro-pneumatic car retarders. These valves are readily adapted for use with automatic or manual controllers. The valve is remotely controlled from an operator's console and responds to the standard retarder control settings of Automatic, XH, H, M, L, or Off.

HS-2 assembly components include two solenoid operated inlet valves, one solenoid operated outlet valve and a Bourdon Tube pressure regulator. Both the inlet and exhaust valves are poppet type, 2-way, normally closed and directional. In certain installations, the exhaust valve is used in conjunction with an auxiliary exhaust valve to provide more rapid exhausting of the cylinders. This device is the X-2 exhaust valve. The X-2 Exhaust Valve is identical to the HS-2's inlet and exhaust valves. See page 7K(1) for more information.

Bourdon tubes are used in the pressure regulator which controls the air for retarder standby, preset and ceiling pressures.

## Specifications

***Operating Supply Pressure Limits***

80 psi (min.)
150 psi (max.)

***Solenoid Voltage***

14 Vdc (min.)
24 Vdc (max.)

## Features

- Precision air control for electro-pneumatic retarders
- High speed operation
- Independently variable outlet pressures

## Ordering Information

- Standard HS-2 order number listed below
- Contact US&S Sales when ordering for new or upgraded classification yards
- Refer to **SM 5311** for complete parts list

## Service Manual Reference

- Refer to **SM 5311**

| US&S Order Number | Description |
|---|---|
| N451132-0101 | HS-2 Retarder Control Valve |

# X-2 Exhaust Valve

## Features

- Reduces exhaust time providing improved braking performance
- Pilot/solenoid assembly easily removed for inspection and maintenance

## Ordering Information

- Standard X-2 order number listed below
- Contact US&S Sales when ordering for new or upgraded classification yards
- Refer to **SM 5312** for complete parts list

## Service Manual Reference

- Refer to **SM 5312**

| US&S Order Number | Description |
|---|---|
| N451133-0701 | X-2 Exhaust Valve |

### General

US&S's X-2 Exhaust Valve is used in conjunction with the HS-2 Retarder Control Valve to shorten the exhaust time of the retarder. The X-2 incorporates a 2-way, poppet type, normally closed directional valve that is operated by a solenoid.

Valve components include a pilot and solenoid assembly that mount on top of a valve body assembly. This arrangement expedites removal of the pilot/solenoid assembly for routine inspection and maintenance.

The X-2 Exhaust Valve can be mounted on a concrete or cast-iron foundation. All electrical connections are made to a terminal board on the inside cover of the assembly.

UNION SWITCH & SIGNAL

7L(1)
Rev. 5/97

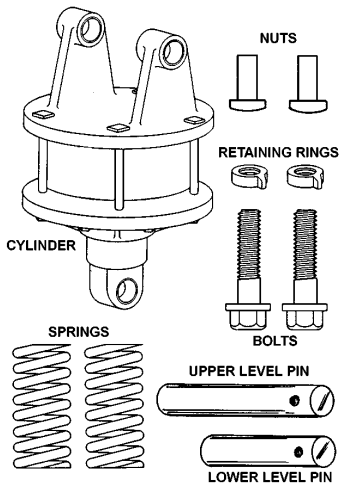
# Mini-Care Cylinder Replacement Kits

Mini-Care cylinder replacement kits help upgrade older model US&S retarders to the performance standards of today's retarders. These kits are easily installed in the field and, once installed, may be completely reconditioned in the field without having to remove the cylinders from the retarder.

Cast metal design is used for major components to assure long operating life. All bearings are self lubricating, reducing costly maintenance of these components. The tie rod construction has a replaceable fiberglass cylinder and nylon cushion rings for longer wear. Current cylinder cup packings can be used in the Mini-Care units.

Because Mini-Care cylinders have the same working volume as older cylinders, the new units can be operated with existing pneumatic systems. Only a minor adjustment of the Bourdon Tube pressure settings is required when the replacement cylinder has a larger diameter than the original cylinder.

Kits are available with 14-1/2" and 12" diameter, for converting 6" stroke to 3 3/8" stroke cylinders. The 3 3/8" stroke kits include a complete cylinder plus chrome plated upper and lower lever pins, while the 6" stroke kits also include two springs, two bolts, two retaining rings and two nuts. These are shown in the accompanying diagram.




| US&S Order Number | Description |
|---|---|
| X451610-2302 | Mini-Care Retarder Cylinder Replacement Kit: 14 1/2" diameter cylinder, inc. upper and lower lever pins |
| X451610-2202 | Mini-Care Retarder Cylinder Replacement Kit: 12" diameter cylinder, inc. upper and lower level pins |

## Features

- Improve performance, reduces maintenance of older retarders
- Self-lubricating
- Kits fit Models 31, 32, 66, and 67

## Ordering Information

- Standard order number for 14 1/2" and 12", 3 3/8" stroke cylinder listed above
- Contact US&S Sales to order other types of kits and individual components of these kits

UNION SWITCH & SIGNAL

7M(1)
Rev. 5/97

# DR-50 Radar

## Features

- Precision car velocity measurement
- Gunn diode source minimizes maintenance, recalibration
- Easily installed and aligned

## Ordering Information

- Standard DR-50 unit and installation kit order numbers listed below

## Service Manual Reference

- Refer to **SM 6121**

The DR-50 Gunn Diode Doppler Radar Unit incorporates Doppler radar circuit design for velocity measurement in classification yard retarder speed controls. It uses a solid-state Gunn diode microwave source to minimize replacement and recalibration of microwave components. The resulting reduction in equipment permits a compact, fully self-contained unit requiring minimal cabling connections.

The DR-50 is contained in a rugged, sheet steel enclosure with a removable top cover. It is designed for mounting between or outside the rails, and provides full exterior protection for internal components. The front of the unit contains a non-metallic RF “window”.

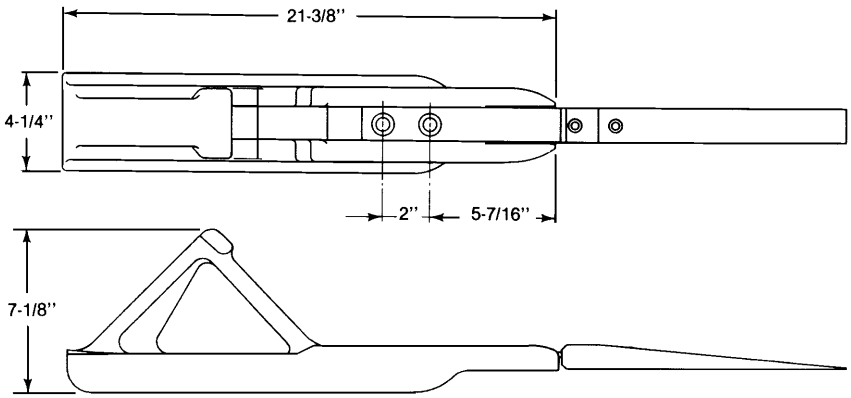
Mounting and aiming is accomplished with four adjustable legs on a single mounting plate. Optional mounting hardware includes steel mounting frames, cast iron mounting piers, and a protective cover for dragging equipment. The unit is also shock mounted internally for vibration protection. DR-50 internal components are contained on a single subplate attached with thumb screws to simplify removal and installation in the field. No external check (calibration) signal is required for the DR-50. This signal (784.7 Hz) is generated and controlled internally.

## Specifications

| | | | |
|---|---|---|---|
| ***Operating Temps*** | -40$^{o}$ to +70$^{o}$C | ***Size*** | 26” x 15 5/8” x 12 7/8” |
| ***Frequency*** | 10.525 GHz +/- 21 MHz | ***Spurious Emission*** | No more than -44 dB over full range, except as assigned frequency |
| ***Frequency Stability*** | +/- 0.2% of assigned frequency | ***Range*** | 150 feet, nominal |
| ***RF Power Output*** | 125 mW (max.), 50 mW (min.) | ***Power Input*** | 95-125 Vac, 60 Hz, 12-14 W |

| US&S Order Number | Description |
|---|---|
| N451127-0301 | Radar unit for mounting on 1 cast iron base |
| X451474-0602 | Kit: Radar (N451127-0301), 1 cast iron base, mounting hardware (outside of rails) |
| N306403 | Cast iron foundation base |
| N451128-2101 | Radar Gunn diode chassis only |

# Hand Skates




## Features

- Effective stopping action for rolling cars

## Ordering Information

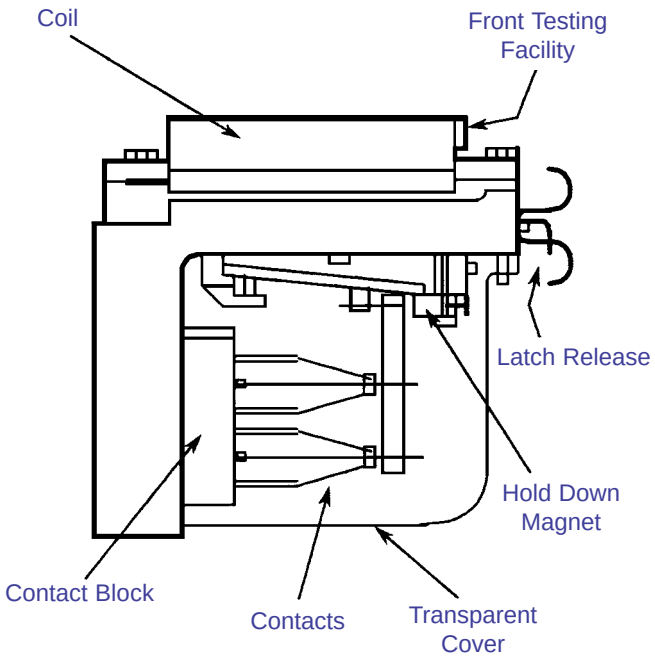
- Standard hand skate ordering number listed below

### General

US&S classification yard hand skates put a final stop to slow rolling cars in classification yards, and may be used at any installation where this action is needed. These units are extremely rugged, yet fully portable and are provided with a replaceable tail.

| US&S Order Number | Description |
|---|---|
| N301489<br>X301543 | Hand skate w/replaceable tail<br>Replaceable tail kit |

# US&S PN-Series Vital Plug-In Relays - *General*




## Features

- Plug-in design permits quick installation or removal
- Indexed to assure proper mounting
- Sturdy plug-in base for every relay model
- Operates over wide temperature range

## General Ordering Information

- Make certain to select the proper relay operating specifications for the application.

## Service Manual Reference

- See Individual Relay Reference

### General

US&S vital plug-in relays serve a multitude of functions in both railroad and transit applications. These time proven relays are space saving, easily installed or removed, and can be handled in the field without disturbing coil or contact wiring.

### High Quality Design & Assembly

All components of US&S plug-in relays are constructed according to rigid quality control standards and are thoroughly tested before shipment. All relays incorporate a transparent molded cover over the relay contacts and armature structure. The cover is sealed to the frame with a gasket that assures a tight, dust-proof and moisture proof seal.

Coils are encapsulated for protection against mechanical damage and moisture. Magnetic circuits are made of non-aging materials. The air gap is not disturbed when the coil is removed or the contact springs adjusted. Relays with an adjustable magnetic shunt may be adjusted for magnetic hold-down force without changing the contact adjustment or the hold-down pole-piece position.

Contact fingers and springs utilize a simple, reliable design and are heat treated to assure uniformity of material and contact stability. The heavy contact fingers extend through the base to serve as plug connectors. Heel contacts are actuated by operating arms pivoted by the armature. Contact surfaces have sufficient wiping action to be self-cleaning. Contact materials and capabilities are as follows unless otherwise noted.

### Contact Designations

Front and back contacts of plug-in relays are designated “F” for front contacts, and “B” for back contacts in ordering tabulations. The dependent contacts are denoted “FB”, while the independent contacts are denoted with and “F” or a “B” alone.

### Testing

Many US&S vital and non-vital plug-in relays provide a front testing capability. The front testing facility is in series with the coil control circuit to permit deenergization of the relay while it is in its service mounting, without disturbing the relay or wiring.

Refer to the specific relay description to determine if the relay has a front testing facility. Testing may also be accomplished through the rear of the relay mounting base without opening a contact or coil circuit.

### Latch

A spring-operated latch holds each plug-in relay securely to its mounting base. The relay is released by pressing a latch release on the front of the relay.

### Indexing

All plug-in relays are equipped with indexing pins to prevent insertion of an incorrect relay into the mounting base. Each relay is accompanied by an indexing plate that is applied to the base at the initial installation.

### System Voltage

This voltage, which is listed in the each particular relay’s ordering tabulation specifications, is prescribed for relays in locally energized circuits. Higher voltage may be used, if required, up to 10 watts power dissipation.

# Vital Plug-In Relays - *Microprocessor Based Timers*

## Features

- Easily programmed in the field
- Solid-state components
- Quartz timing accuracy
- Simplified installation
- Back check contact
- Plug-in replacement for PT-55

## Ordering Information

- Order PN-150EVT and mounting base from tabulation on this page
- For application possibilities of the PN-150EVT, contact US&S Sales

## Service Manual Reference

- Refer to **SM 6498**

### PN-150EVT

The PN-150EVT is a microprocessor-based, vital time element relay originally developed as a direct plug-in replacement for the older PT-55 mechanical time element relay. However, the PN-150EVT is readily capable of being used anywhere a modern and reliable vital delay pick-up relay is needed.

Typical timing functions of the PN-150EVT include; time locking, loss of shunt protection and delayed clearing of signals. This unit is field programmable and requires minimal maintenance.

The PN-150EVT is capable of replacing many older timers currently in use in the field. (See chart on next page for information on replacing other timers with the PN-150EVT.)

***Design Features***

The PN-150EVT is controlled by a microprocessor and its associated circuitry located on a printed circuit board mounted within the relay enclosure. This circuitry ensures that the relay's time delay is accurate and repeatable. The PN-150EVT has no moving parts other than its armature, greatly reducing the need for maintenance.

Two toggle switches located on the face of the relay allow the PN-150EVT to be programmed and adjusted in the field without disassembling the relay or disturbing internal adjustments. When the relay's time interval is not being programmed or adjusted, the two toggle switches are protected by an independent, sealable cover to prevent tampering or accidental manipulation.

A four-character LED display on the face of the relay indicates the status of the relay in operation; deenergized, running or picked, and provides error codes in the case of a detected error. While programming the timing interval, the display prompts the user's actions and indicates the preset timing interval.

The timing interval of the PN-150EVT can be set for anywhere between 0 and 3599 seconds (0 min. - 59 min., 59sec.).When used with the specially designed adapter base, the PN-150EVT cab be plugged directly into an existing PT-55 base with no wiring changes being required.

## Specifications

| | | | |
|---|---|---|---|
| ***Dimensions*** | H=8 1/4", W= 3 1/4", D= 9 7/65" | ***Accuracy*** | Better than 0.1% under all conditions at any time setting. |
| ***Oper. Voltage*** | 9-30VDC filtered or 9-24 VDC unfiltered. Inputs protected against reverse polarity. | ***Timing Range*** | *Low Range*: 0 to 59.9 secs. in 0.1 second increments<br>*High Range:* 0 to 59 minutes, 59 seconds (3599 seconds) in 1 second increments |
| ***Contacts*** | 3F-1B, all silver impregnated carbon, 4 amps at 30 VDC or 175 VAC | | |

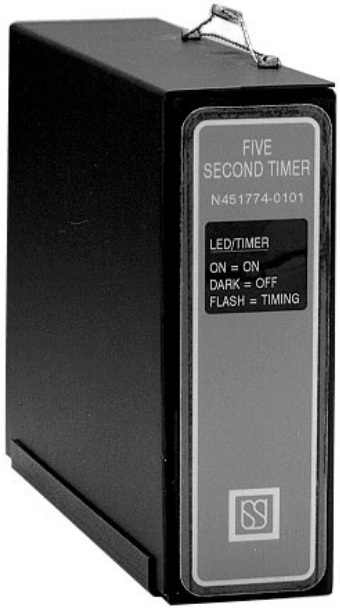
## PN-150EVT Assemblies, Mounting Kits, and Mounting Bases

| US&S Order Number | Description |
|---|---|
| N40102501 | PN-150EVT Relay with standard base |
| N40101001 | PN-150EVT with PT-55 adapter base |
| N40101701 | PN-150EVT relay only |
| N40101801 | PT-55 adapter base only |
| N373904 | Single unit shelf mounting bracket, without base or hardware. |
| N40102901 | PN-150EVT GRS Style mounting base with #14-16 wire gauge contacts |
| N40102902 | PN-150EVT GRS Style mounting base with #18-20 wire gauge contacts |

## PN-150EVT Equipment Lists for Replacing Older Timers

| Timer to be Replaced | Order US&S Part No's. | Description |
|---|---|---|
| PT-55 | N40101001 | Plug-in Replacement package for PT-55 |
| PN-150T | N40102501 | PN-150EVT with standard base (requires minor changes to fit application) |
| Flexikron | N40102501 | PN-150EVT with standard base (requires minor changes to fit application) |

**NOTE** Contact your US&S Sales Representative for further information on timers that can be replaced by the PN-150EVT




## Five Second Fixed Electronic Vital Timer

Union Switch & Signal's Five Second Fixed Electronic Vital Timer is a microprocessor based product that provides an accurate and dependable slow pick-up repeater of a relay.

In most applications, this solid-state timer would be used as a front contact repeater of a track relay for loss of shunt protection.

The Five Second Fixed Timer is physically interchangeable with Union Switch & Signal's older Five Second Timers (N451774-0101, -0102, and -0103), making it an ideal replacement for these timers. It is also electrically interchangeable with this timer in most applications.

An LED on the front of the timer indicates the unit's operating status: dark with no input, it flashes at the instant power is applied up until voltage is delivered to the output and then illuminates steady after the time delay is expired. The unit is wired via a 5-point terminal strip on the rear of the unit.

### Specifications

| | |
|---|---|
| ***Dimensions*** | H= 6 1/16", W= 2 1/4", D= 8 3/8" |
| ***Oper. Voltage*** | 9-30VDC from battery source or 8-24 VDC unfiltered rectified source. |
| ***Weight*** | 2 lbs. (approximately) |
| ***Mounting*** | Bracket compatible with US&S or GRS relays on std. racks<br>Bracket also compatible with wall mounting |

### Features

- No need for programming
- Solid-state components
- Accurate timing
- Simplified installation
- Physically interchangeable with US&S's older Five Second Timer
- Low maintenance

### Ordering Information

- Order Fixed Timer from tabulation on next page
- Contact your US&S Sales person for information on fixed timers with intervals other than five seconds

### Service Manual Reference

- Refer to **SM 6499**

| US&S Order No. | Description |
|---|---|
| N34300101 | Basic unit without mounting bracket |
| N34300102 | Timer with US&S mounting bracket |
| N34300103 | Timer with GRS mounting bracket |

# Vital Plug-In Relays - *PN-150F DC Flasher*

## General

The PN-150F flasher relay is an electronically driven biased dc relay intended for highway crossing flasher signal service. Its electronic flasher package uses a mounting base for installation and quick disconnect wiring for rapid field replacement of the unit.

It is not necessary to remove the relay from service to replace the flasher package. The flash rate is externally adjustable between 45 or 60 flashes per minute (+/- 5). A failure of the electronic package results in steady energy to one signal or intermittent flashing.

Contacts of the PN-150F are silver alloy. The relay is intended for use with the contacts wired in groups of three: 1F, 2F, 3F joined, and 1B, 2B, 3B joined. In this configuration, the relay alternately flashes the left-hand and then the right-hand signal.

When wired in shunting service, each bank of three contacts is rated to flash 25 amperes ac lamp load maximum. Thus, each flasher can flash 50 amperes ac lamp load at 10 watts. DC power for the relay may be obtained from a battery or rectifier.

| US&S Order Number | Contacts | System Power | Flashes/ Minute |
|---|---|---|---|
| N322530-701 | 6FB | 8-12 VDC @ 0.2A | 45 or 60 (+/- 5) |
| X451018-3001 | Flasher Kit: Includes PN-150F Relay, flasher relay module, mtg. bracket, jumpers, varistor, hardware | | |
| X451018-3003 | Flasher Kit & Relay Mounting Base: Includes everything in X451018-3001 plus mounting base and associated hardware | | |

### Service Manual Reference

- Refer to **SM 6348**

### Mounting Base Order No.

- **N451376-0305 for #10 wire size**
- **N451376-0302 for #16 wire size**

# Vital Plug-In Relays DC-Line - *Biased & Neutral*

## PN-150B Relay

The PN-150B relay is designed for use in line and logic circuits requiring contact capacities up to 4 amperes. (If greater capacity is required, the PN-150HD relay is recommended. If an equivalent relay with more contacts is required, the PN-250B relay is recommended.) Because the PN-150B relay is naturally biased, it becomes a battery checking relay to ensure that the logic energy has the proper polarity. This is especially important where some of the circuits are polarity responsive, such as in switch repeating and polar line circuits. Contacts of the PN-150B relay are standard low voltage silver to silver impregnated carbon front and silver to silver back. All PN-150B relays use Lexan covers. Refer to the ordering tabulation below for operating specifications.

| US&S Order Number | Description | | | | | | |
|---|---|---|---|---|---|---|---|
| | Front Test | Contacts | Coil. Resis. (Ohms) | Energization* | | Sys. Voltg. | See Notes |
| | | | | Amps | Volts | | |
| N322500-706 | Yes | 6FB Std. | 25 | 0.0504 | 1.26 | -- | 1 |
| N322500-704 | Yes | 6FB Std. | 100 | 0.0264 | 2.64 | -- | 1 |
| N322500-705 | Yes | 6FB Std. | 240 | 0.0177 | 4.24 | -- | 1 |
| N322500-701 | Yes | 6FB Std. | 400 | 0.0132 | 5.3 | 10 | -- |
| N322500-702 | Yes | 6FB Std. | 800 | 0.0105 | 8.4 | 12-14 | -- |
| N322500-703 | Yes | 6FB Std. | 1300 | 0.0082 | 10.7 | 16-24 | -- |
| N322500-801 | No | 6FB Std. | 400 | 0.0132 | 5.3 | 10 | -- |
| N322500-802 | No | 6FB Std. | 800 | 0.0105 | 8.4 | 12-14 | -- |
| N322500-803 | No | 6FB Std. | 1300 | 0.0082 | 10.7 | 16-24 | -- |
| N322500-809 | No | 4FB, 2F, 1 Std. | 400 | 0.0132 | 5.3 | 10 | -- |
| N322500-808 | No | 4FB, 2F, 1 Std. | 800 | 0.0105 | 8.4 | 12-14 | -- |
| N322500-807 | No | 4FB, 2F, 1 Std. | 1300 | 0.0082 | 10.7 | 16-24 | -- |

NOTE *Value at which relay will become energized. Response will generally occur at some lower value.

### Service Manual Reference

- Refer to **SM 4596**

### Mounting Base Order No.

- **N451376-0302**

## PN-150HD Relay

The PN-150HD relay has six transfer contacts. Four are heavy duty contacts that can carry 15 amperes up to 30 volts dc and ac. The other two contacts are standard contacts with a 4-ampere capacity. This relay can be used in the place of a PN-150B when greater contact capacity is needed. The PN-150HD requires the indicated polarity for operation. However, due to the high back contact pressure, it cannot be considered a true biased relay in accordance with AAR specifications. Contacts of the PN-150HD are:

- Heavy duty (HD) silver to silver impregnated carbon front and silver to silver back.
- Standard (Std.) low voltage silver to silver impregnated carbon front and silver to silver back.

| US&S Order Number | Description | | | | | |
|---|---|---|---|---|---|---|
| | Front Test | Contacts | Coil. Resis. (Ohms) | Energization* | | Sys. Voltg. |
| | | | | Amps | Volts | |
| N322505-701 | Yes | 4FB H.D., 2FB Std. | 400 | 0.0132 | 5.3 | 10 |
| N322505-702 | Yes | 4FB H.D., 2FB Std. | 800 | 0.0105 | 8.4 | 12-14 |
| N322505-803 | No | 4FB H.D., 2FB Std. | 1300 | 0.0082 | 10.7 | 16-24 |

NOTE *Value at which relay will become energized. Response will generally occur at some lower value. Contacts: 1, 3, 4, and 6 (FB H.D.) 2 and 5 (FB Std.)

### Service Manual Reference

- Refer to **SM 4596E**

### Mounting Base Order No.

- **N451376-0305 for #10 wire size**
- **N451376-0302 for #16 wire size**

## PN-150BD Biased Relay

The PN-150BD relay is a 3-position relay that is a combination of two biased relays to sense that a circuit is (a) deenergized, (b) energized with normal polarity, or (c) energized with reverse polarity. Each applied polarity energizes one of the biased armatures which, in turn, actuates three transfer contacts.

Since a polarity change causes one set of front contacts to open before the other set closes, there is a short period when neither set is closed. Generally, a PN-150BSR relay is used as a repeater to bridge the changeover when a continuous "circuit energized" output is required. Contacts of the PN-150BD relay are standard low voltage silver to silver impregnated carbon front and silver to silver back.

Refer to the ordering tabulation below for operating specifications.

### Service Manual Reference

- Refer to **SM 4596D**

### Mounting Base Order No.

- **N451376-0302**

| US&S Order Number | Description | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Front Test | Contacts | | Coil. Resis. (Ohms) | Energization* | | Recom. Working Voltage for 0.9 Sec. Rev. Time | Sys. Voltg. | See Notes |
| | | Norm. | Rev. | | Amps | Volts | | | |
| N322504-702 | Yes | 3FB Std. | 3FB Std. | 100 | 0.0283 | 2.83 | 3.05 | -- | 1,2 |
| N322504-701 | Yes | 3FB Std. | 3FB Std. | 400 | 0.0141 | 5.65 | 6.08 | 10 | 2 |
| N322504-703 | Yes | 3FB Std. | 3FB Std. | 800 | 0.0112 | 8.95 | 9.67 | 12-14 | 2 |
| N322504-803 | No | 3FB Std. | 3FB Std. | 800 | 0.0112 | 8.95 | 9.67 | 12-14 | 2 |

NOTE *Value at which relay will become energized. Response will generally occur at some lower value.
1- Normally used in series with another relay.
2- Contacts: 1, 4, 5: FB normal 2, 3, 6: FB reverse

## PN-250B Biased Relay

The PN-250B relay is a biased relay designed for use in line and logic circuits. It is used in place of PN-150B relay when additional contacts are required. Coils of this relay may be externally connected in series or in multiple. For a relay that operates on lower energization values, the PN-250BE relay is recommended. Contacts of the PN-250B relay are standard low voltage silver to silver impregnated carbon front and silver to silver back.

All PN-250B relays use a Lexan cover. Refer to the ordering tabulation below for operating specifications.

### Service Manual Reference

- Refer to **SM 4597**

### Mounting Base Order No.

- **N438689-003**

| US&S Order Number | Description | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Front Test | Contacts | Coil. Resis. (Ohms) | | Series Energ.* | | Multi.Energ.* | | Sys. Voltg. | See Notes |
| | | | Series | Mult. | Amps | Volts | Amps | Volts | | |
| N322554-701 | Yes | 6FB, 6F, 3B Std. | 1000 | 250 | 0.0104 | 10.43 | 0.020 | 5.25 | 16-24 | 1 |
| N322554-702 | Yes | 8FB, 4F, 2B Std. | 1000 | 250 | 0.0209 | 5.22 | 0.0209 | 5.22 | 10-14 | 2 |
| N322554-801 | No | 6FB, 6F, 3B Std. | 1000 | 250 | 0.0104 | 10.43 | 0.0205 | 5.22 | 16-24 | 1 |
| N322554-802 | No | 8FB, 4F, 2B Std. | 1000 | 250 | 0.0209 | 5.22 | 0.0209 | 5.22 | 10-14 | 2 |

NOTE *Value at which relay will become energized. Response will generally occur at some lower value.
1- Contacts: 1, 2, 3, 4, 5, 6: FB 7, 8, 9, 10, 11, 12: F 13, 14, 15: B
2- Contacts: 1, 3, 4, 6, 8, 10, 11, 13: FB 2, 7, 9, 14:F 5, 12: B

## PN-150N Neutral Relay

The PN-150N relay is intended for applications that require response to energy of either polarity. If this is not a requirement for the application, the PN-150B relay should be used instead. The PN-150N relay is equipped with six standard (Std.) low voltage silver to silver impregnated carbon front and silver to silver back contacts. Refer to the tabulation below for operating specifications.

### Service Manual Reference

- Refer to **SM 4596X**

### Mounting Base Order No.

- **N451376-0302**

| | Description | | | | |
|---|---|---|---|---|---|
| US&S Order Number | Front Testing | Contacts | Coil. Resis. (Ohms) | Energization | |
| | | | | Amps | Volts |
| N322502-701 | yes | 6FB, Std. | 240 | 0.0191 | 4.6 |

# Vital Plug-In Relays DC-Line
## *Slow Dropaway and/or Pick-Up*

### PN-150BSR Relay

This relay is a slow release biased relay that remains in the energized position approximately one second after control energy is removed. This feature is used to bridge the transfer time of the controlling relay contacts to prevent loss of information.

A typical example is the bridging changeover time of a PN-150BD relay from normal to reverse (or vice-versa).

For longer delay time, refer to the PN-259BSR and PN-259SRA relays. Contacts are low voltage silver to silver impregnated front and silver to silver back.

Refer to tabulation below for operating specifications.

**Service Manual Reference**

- Refer to **SM 4596B**

**Mounting Base Order No.**

- **N451376-0302**

| US&S Order Number | Description | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Front Test | Contacts | Coil. Resis. (Ohms) | Energization* | | Min. D.A. Time | | Sys. Voltg. | See Notes |
| | | | | Amps | Volts | 0.8 Sec @V | 1.0 Sec @V | | |
| N322503-701 | Yes | 6FB Std. | 100 | 0.0345 | 3.45 | 4.7 | 5.6 | 10 | 1 |
| N322503-702 | Yes | 6FB Std. | 250 | 0.0223 | 5.58 | 7.5 | 9.0 | 12-16 | 1 |
| N322503-802 | No | 6FB Std. | 250 | 0.0223 | 5.58 | 7.5 | 9.8 | 12-16 | 1 |
| N322503-804 | No | 4FB, 2F, 1B Std. | 250 | 0.0223 | 5.58 | 7.5 | 9.0 | 12-16 | 2 |

NOTE *Value at which relay will become energized. Response will generally occur at some lower value.

| | | | |
|---|---|---|---|
| 1- Contacts: | 6 FB | 1 through 6: | FB |
| 2- Contacts: | 4FB, 2F, 1B | 1, 3, 4, and 6: | FB |
| | | 2 and 7: | F |
| | | 5: | B |

### PN-258B Relay

This relay is a slow pick up biased relay that has a delayed response to energization of approximately one second, depending on the voltage applied. The release is the same as a standard relay.

Contacts are low voltage silver to silver impregnated front and silver to silver back. Refer to the tabulation below for operating specifications.

**Service Manual Reference**

- Refer to **SM 4597**

**Mounting Base Order No.**

- **N438689-001**

| US&S Order Number | Description | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Front Test | Contacts | Coil. Resis. (Ohms) | Energization* | | Min. P.U. Time | | Service Energization Volts** | Sys. Volt. |
| | | | | Amps | Volts | @ 100% Service Energy | @ 110% Service Energy | | |
| N322551-701 | Yes | 6FB Std. | 1400 | 0.0055 | 7.5 | 1.05 | 0.85 | 10.00 | 10 |
| N322551-703 | Yes | 6FB Std. | 2000 | 0.0045 | 9.0 | 1.05 | 0.85 | 12.0 | 12 |
| N322551-803 | No | 6FB Std. | 2000 | 0.0045 | 9.0 | 1.05 | 0.85 | 12.0 | 12 |

**NOTE** *Values below which relay may not become energized. Response will generally occur at some lower value.
**Voltage recommended in order to ensure a one second delay.

## PN-258BSR Relay

This relay is a slow pick up and a slow release biased relay. The delayed response to energization is approximately 2 seconds, and 1 second to deenergization.

Note in the PN-258BSR tabulation that these times may vary with the applied voltage. Contacts are low voltage silver to silver-impregnated front and silver to silver back. Front testing is available on all PN-258BSR relays. Refer to tabulation below for operating specifications.

### Service Manual Reference

- Refer to **SM 4597**

### Mounting Base Order No.

- **N438689-001**

| US&S Order Number | Description | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Contacts | Coil. Resis. (Ohms) | Energization* | | Service Energiz. Volts** | Min. P.U. Time | | Min. D.A. Time | |
| | | | Amps | Volts | | @ 100% Service Energy | @ 110% Service Energy | @ 100% Service Energy | @ 110% Service Energy |
| N322551-702 | 6FB Std. | 350 | 0.0214 | 7.50 | 10.00 | 2.2 | 1.8 | 1.1 | 0.7 |
| N322551-705 | 6FB Std. | 500 | 0.0180 | 9.01 | 12.00 | 2.2 | 1.8 | 1.1 | 0.7 |

NOTE Both relays equipped with front testing.
* Values below which relay may not become energized.
**Voltage recommended in order to ensure a one second delay.

## PN-259BSR & SRA Relays

### PN-259BSR Relay

The PN-259BSR is a slow release biased relay that has a delayed response to deenergization of 2.75 to 3.5 seconds. This relay is equipped with six standard transfer (FB) contacts capable of carrying up to 4 amperes. When used for a crossing gate delay, its control should be arranged to snub its coil upon deenergization. Heavy Duty (HD) contacts are silver to silver impregnated carbon front and silver to silver back. Standard (Std.) contacts are low voltage silver to silver impregnated front and silver to silver back. Refer to tabulation below for operating specifications. Front testing is available on all PN-259BSR relays.

### PN-259SRA Relay

This relay is a special version of the PN-259BSR with four heavy duty transfer contacts capable of carrying up to 15 amperes. This relay is typically used to delay the release of highway crossing gates, although it is not restricted to that purpose. When used for a crossing delay, its control should be arranged to snub its coil upon de-energization. Heavy duty (HD) contacts are silver to silver impregnated carbon front and silver to silver back. Standard (Std.) contacts are low voltage silver to silver impregnated front and silver to silver back. Refer to tabulation below for operating specifications. Front testing is available on all PN-259SRAs.

### Service Manual Reference

- Refer to **SM 4597 (BSR), SM 4563H (SRA)**

### Mounting Base Order No.

- **N438689-001**

| US&S Order Number | Description | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Type | Contacts | Coil. Resis. (Ohms) | Energization | | System Energization for 2.75 to 3.5 sec. Dropaway Time | | Sys. Voltage | Notes |
| | | | | Amps | Volts | Amps | Volts | | |
| N322562-001 | PN-259SRA | 4FB H.D. | 225 | 0.0222 | 5.0 | 0.0355 | 8.0 | 12 | -- |
| N322552-702 | PN-259BSR | 6FB Std. | 225 | 0.0222 | 5.0 | 0.0355 | 8.0 | 12 | -- |
| N322552-701 | PN-259BSR | 6FB Std. | 350 | 0.0186 | 6.51 | 0.0298 | 10.0 | 10 | 1 |

NOTE 1- Not recommended for grade crossing relay.

# Vital Plug-In Relays DC-Line
## *Biased, Ordinary Acting, High Dropaway*

### PN-150BTR and PN-150BQS Relays

#### PN-150BTR Relay

This is a biased relay with special characteristics for use as a track relay. External resistors may be required to adjust each track circuit to obtain proper train shunting characteristics (refer to PN-150BH relays also).

The PN-150BTR relay is equipped with standard low voltage silver to silver impregnated carbon front and silver to silver back contacts. Front testing is available on all PN-150BTR relays.

#### PN-150BQS Relay

This is a special quick shunting relay designed for use with the FR HI-Shunt Track Unit. It is used where poor shunting characteristics may exist, such as in classification yards with film on the rail.

The high resistance winding is externally snubbed with a diode resistor (US&S Part Number N377308) to provide increased immunity to intermittent loss of shunt. The PN-150BQS relay is equipped with standard low voltage silver to silver impregnated carbon front and silver to silver back contacts. Refer to tabulation below for operating specifications. Front testing is available on all PN-150BQS relays.

#### Service Manual Reference

- Refer to **SM 4596A (PN-150BTR)**

#### Mounting Base Order No.

- **N451376-0302**

| US&S Order Number | Description | | | | | | |
|---|---|---|---|---|---|---|---|
| | Type | Contacts | Coil. Resis. (Ohms) | Min. D.A. Time | | Energization* | |
| | | | | Amps | Volts | Amps | Volts |
| N322501-701 | PN-150BTR | 6FB, Std. | 1 | 0.132 | 0.132 | 0.250 | 0.25 |
| N322501-702 | PN-150BTR | 6FB, Std. | 4 | 0.069 | 0.276 | 0.131 | 0.52 |
| N322501-703 | PN-150BQS | 6FB, Std. | 11/25 | 0.097 | 1.070 | 0.180 | 1.98 |
| N322501-704 | PN-150BTR | 6FB, Std. | 2 | 0.091 | 1.182 | 0.173 | 0.35 |
| N322501-705 | PN-150BTR | 6FB, Std. | 13 | 0.037 | 0.390 | 0.071 | 0.92 |

NOTE *Value at which relay will become energized. Response will generally occur at some lower value.

## PN-150BH Relay

This relay is a biased high drop away relay designed for use in track circuits. It has the special characteristic of minimum release at about 75% of the energization value. This results in better shunting characteristics than can be obtained with the PN-150BTR relay. In order to achieve close tolerances (see tabulation below), a special contact arrangement of one transfer, one front and one contact is used. If more contacts are required, the PN-150B relay can be used as a repeater. The PN-150BH relay is equipped with standard low voltage silver to silver impregnated carbon front and silver to silver back contacts. Refer to the ordering tabulation below for operating specifications and additional application notes. All PN-150BH relays incorporate front testing.

### Service Manual Reference

- Refer to **SM 4551R**

### Mounting Base Order No.

- **N451376-0302**

| US&S Order Number | Description | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Contacts | Coil. Resis. (Ohms) | | Minimum D.A. | | Energization* | | Notes |
| | | Series | Mult. | Amps | Volts | Amps | Volts | |
| N322511-001 | 1FB, 1F, 1B, Std. | 2.0 | --<br>0.5 | 0.120<br>0.240 | 0.240<br>0.120 | 0.160<br>0.320 | 0.320<br>0.160 | 1<br>1 |
| N322511-002 | 1FB, 1F, 1B, Std. | 4.0<br>-- | --<br>1.0 | 0.086<br>0.172 | 0.344<br>0.172 | 0.115<br>0.230 | 0.460<br>0.230 | 1<br>1 |
| N322511-006 | 1FB, 1F, 1B, Std. | 400.0 | -- | 0.0094 | 3.76 | 0.0126 | 5.03 | 1,2 |
| N322511-003 | 1FB, 1F, 1B, Std. | 2000.0<br>-- | --<br>500.0 | 0.0045<br>0.0090 | 9.05<br>4.52 | 0.0060<br>0.0121 | 12.1<br>6.05 | 1,3<br>1 |
| N322511-005 | 1FB, 1F, 1B, Std. | 2.6<br>-- | --<br>0.65 | 0.137<br>0.274 | 0.356<br>0.178 | 0.190<br>0.380 | 0.494<br>0.247 | 1,4<br>1 |
| N322511-011 | 1FB, 1F, 1B, Std. | 4.0<br>-- | --<br>1.0 | 0.090<br>0.181 | 0.362<br>0.181 | 0.121<br>0.242 | 0.484<br>0.242 | 1<br>1 |

NOTE *Value at which relay will become energized. Response will generally occur at some lower value.

1- Contacts:

| | |
|---|---|
| 1 | FB |
| 2 | B |
| 3 | F |

2- Special relay for use with AFO-II equipment.

3- Special relay for use with AFO equipment.

4- Relay designed to be immune to ac; for use in electrified territory (with ac propulsion).

# Vital Plug-In Relays AC Track
## *Two Element AC Vane Relays*

### PV-250 Relay

The PV-250 Relay is a two element AC Vane relay used in track, line, power-off and ground detection circuits. As a track relay, it may be used in single or double rail circuits with dc propulsion.

Since it is a two element relay, it must be used with suitable apparatus to provide adequate displacement between the local and control (track) windings.

Contacts of the PV-250 relay are standard (Std.) low voltage silver to silver impregnated carbon fronts and silver to silver backs. Refer to the ordering table below for operating specifications.

**Note on table:** Where two sets of data are given for a relay, the top set covers control windings in series and the bottom set control windings in parallel. For relays having only one set of data, the data are for control windings in series only.

### Service Manual Reference

- Refer to **SM 4574**

### Mounting Base Order No.

- **N438689-003**

| US&S Order Number | Description | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Front Testing | Contacts | Minimum Dropaway | Operating Values @ Ideal Phase Relations | | | | Local | | Notes |
| | | | | P.U. +/- 5% | | Full Stroke | | | | |
| | | | | Amps | Volts | Amps | Volts | Volts | Hz | |
| N322555-801 | No | 6F, 4B | 80% P.U. | 0.283 | 0.418 | 0.487 | 0.72 | 115 | 60.0 | 1,7,9 |
| | | | 80% P.U. | 0.566 | 0.209 | 0.974 | 0.36 | 115 | 60.0 | 2 |
| | | | 80% P.U. | 0.278 | 0.36 | 0.478 | 0.62 | 110 | 50.0 | 1 |
| | | | 80% P.U. | 0.566 | 0.18 | 0.956 | 0.31 | 110 | 50.0 | 2 |
| N322555-001 | Yes | 6F, 4B | 80% P.U. | 0.283 | 0.418 | 0.487 | 0.72 | 115 | 60.0 | 1,7,9 |
| | | | 80% P.U. | 0.566 | 0.209 | 0.974 | 0.36 | 115 | 60.0 | 2 |
| | | | 80% P.U. | 0.278 | 0.36 | 0.478 | 0.62 | 110 | 50.0 | 1 |
| | | | 80% P.U. | 0.566 | 0.18 | 0.956 | 0.31 | 110 | 50.0 | 2 |
| N322555-002 | Yes | 6F, 4B | 80% P.U. | 0.442 | 0.309 | 0.75 | 0.525 | 115 | 25.0 | 7,10 |
| | | | 80% P.U. | 0.884 | 0.155 | 1.5 | 0.269 | 115 | 25.0 | 7 |
| N322555-004 | Yes | 6F, 4B | 91% P.U. | 0.158 | 97.0 | 0.181 | 111.0 | 115 | 60.0 | 3,7 |
| N322555-010 | Yes | 6F, 4B | 80% P.U. | 0.51 | 0.3 | 0.77 | 0.43 | 115 | 100.0 | 2,7,13 |
| N322555-005 | Yes | 6F, 4B | 90% P.U. | 0.115 | 3.67 | 0.16 | 5.1 | 115 | 60.0 | 1,4,7 |
| N322555-805 | No | 6F, 4B | 90% P.U. | 0.115 | 3.67 | 0.16 | 5.1 | 115 | 60.0 | 1,8 |
| N342555-809 | No | 2F, 2B | 90% P.U. | 0.044 | 2.74 | 0.0495 | 3.05 | 115 | 60.0 | 1,8,12 |
| N342555-811 | No | 2F, 2B | 90% P.U. | 0.055 | 2.2 | 0.062 | 2.4 | 115 | 60.0 | 1,8,14 |
| N342555-813 | No | 2F, 2B | 90% P.U. | 0.075 | 3.14 | 0.086 | 3.59 | 90 | 83.3 | 8,16 |
| N342555-814 | No | 2F, 2B | 90% P.U. | 0.295 | 0.704 | 0.322 | 0.767 | 115 | 60/100 | 6,17 |
| N342555-803 | No | 2F, 2B | 90% P.U. | 0.28 | 0.7 | 0.327 | 0.82 | 115 | 60.0 | 6,11 |
| N342555-003 | Yes | 2F, 2B | 90% P.U. | 0.28 | 0.7 | 0.327 | 0.82 | 115 | 60.0 | 1,6,11 |

**NOTE** Energization: Value at which relay will become energized. Response will generally occur at some lower value.

1- Contacts: Control coil in series.
2- Contacts: Control coils in multiples.
3- Power-off relay, SM 4574D.
4- Ground detector relay, SM 4574E
6- Contacts: 2, 3: F; 7, 8: B
7- Contacts: 1,2,3,6,7,8: F; 4,5, 9, 10: B.
8- Contacts: 7, 8: F; 9, 10: B
9- Track circuit relay, SM-4574A
10- Track Relay, SM-4574B
11- Slow Drop-away Relay, SM-4574C
12- Track Relay, SM-4574F
13- Track Relay, SM-4574G
14- Power-Off Relay, SM-4574J
15- Line Relay, SM-4574L
16- Track Relay, SM-4574M
17- Track Circuit Relay, SM-4574N

# Vital Plug-In Relays DC Line
## *Magnetic Stick and Blow-Out*

### PP-151 Relay

The PP-151 relay is a dc magnetic stick relay that stays in the last operated position after control energy is removed. Full contact pressure is maintained during de-energization to ensure circuit continuity. Refer to the ordering tabulation below for operating specifications.

There are two types of PP-151 relays, wayside and car carried. Refer to the "Cab Signal" section of this catalog for information on the car carried version of the PP-151. Contacts of the PP-151 are as follows: SIC - silver to silver impregnated carbon, normal and reverse. SIL-silver to silver, normal and reverse.

The PP-151 is intended for polar circuits where the last position must be retained on loss of power. The wayside type is designed for polar control, indication circuits and switch control. In the switch control application, it is used in conjunction with or to control type PN-150BM relays.

| US&S Order Number | Description | | | | | |
|---|---|---|---|---|---|---|
| | Front Testing | Contacts | Coil. Resis. (Ohms) | Max. Polar Pick-Up & Working Volts | Min. Polar Pick-Up & Working Volts | Notes |
| N322507-701 | Yes | 6 NR SIC | 240 | 5.52 | 5.42 | -- |
| N322507-703 | Yes | 6 NR SIC | 25 | 1.54 | 1.2 | 1 |
| N322516-701 | Yes | 4 NR SIC<br>2 NR Sil | 240 | 5.52 | 4.25 | 2 |
| N438007-802 | Yes | 6 NR SIC | 400 | 6.85 | 5.3 | -- |
| N438007-804 | No | 6 NR SIC | 400 | 6.85 | 5.3 | -- |

**NOTES** Energization- Value at which relay will become energized. Response will generally occur at some lower value.
1- Normally used in series with other relays for polar control and indication circuits.
2- Used in combination with PN-150BM relay for switch control.

### Service Manual Reference

- Refer to **SM 4596G**

### Mounting Base Order No.

- **N451376-0302**

UNION SWITCH & SIGNAL

## PN-150BM Relay

The PN-150BM is a biased relay that has contacts equipped with magnetic blowouts. These consist of silver to silver impregnated front and silver to silver back. The contacts can carry 15 amperes up to 120 Vdc or 300 Vac. The PN-150BM is typically used in conjunction with the PP-151 and PN-150SO relays to control electric switch machines. All PN-150BM relays are provided with front testing.

### Service Manual Reference

- Refer to **SM 4551M**

### Mounting Base Order No.

- **N451376-0302**

| US&S Order Number | Description | | | | | |
|---|---|---|---|---|---|---|
| | Contacts | Coil. Resis. (Ohms) | Energization* | | Sys. Volts | See Notes |
| | | | Amps | Volts | | |
| N322517-001 | 2F, Mag. H.D. | 240 | 0.0209 | 5.02 | 10-16 | 1 |
| N322524-001 | 2F, 2B, Mag. H.D. | 240 | 0.025 | 6.0 | 10-16 | 1 |
| N322525-001 | 3F, Mag. H.D. | 240 | 0.025 | 6.0 | 10-16 | 1 |

**NOTES** *Value at which relay will become energized. Response will generally occur at some lower value.

| | | | |
|---|---|---|---|
| 1- Contacts: | 2F; | 1,2 | F circuit fronts toward + battery. |
| 2- Contacts: | 3F; | 1, 2, 3 | F circuit fronts toward + battery |
| 3- Contacts: | 2F, 2B | 1,2 | F circuit heels toward + battery |
| 4- Contacts: | | 3,4 | B circuit heels toward + battery |

# Vital Plug-In Relays Switch Control
## *DC and AC Decoding*

### PN-150SO & PN-152SO Relays

The PN-150SO and PN-152SO relays are used with the PN-150BM relay to cut off power to a dc switch machine that has stalled. The motor current flows through the coil; when the operating time (as given in the tabulation below) is exceeded, the relay becomes energized. This opens the control circuit of the PN-150BM relay which, in turn, cuts off power to the switch machine. The circuit is arranged so that, once the PN-150SO relay is energized, it will remain energized until the switch control is reversed. The PN-150SO relay has both sets of coil leads available for external circuit arrangements.

### Service Manual Reference

- **SM 4571 (150SO)**
- **SM5929 (152SO)**

### Mounting Base Order No.

- **N451376-0302**

| US&S Order Number | Type | Description | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Resistance Coil + Resistor (Ohms) | | Operating Time - Seconds (+/- 10%) | | | | | | | |
| | | Oper. | Stick | 4 Amps | 5.5 Amps | 8 Amps | 12 Amps | 13 Amps | 14 Amps | 15 Amps | 20 Amps | Notes |
| N322512-001 | PN-150SO | 0.039 | 135 | -- | -- | 40.0 | 8.0 | -- | -- | -- | -- | 1 |
| N322512-002 | PN-150SO | 0.0135 | 135 | -- | -- | -- | -- | -- | -- | 25.0 | 6.0 | 2 |
| N322522-802 | PN-152SO | 0.0456 | 750 | -- | -- | -- | -- | 5.0 | -- | 3.0 | -- | 3 |

**NOTES** Value at which relay will become energized. Response will generally occur at some lower value.
1- For switch machine having clutch adjusted to slip at 12 amperes.
2- For switch machine having clutch adjusted to slip at 20 amperes.
3- For switch machine having clutch adjusted to slip at 13 amperes.

## PN-258BC Decoding Relay

The PN-258BC relay is a biased decoding relay that normally operates from a decoding transformer. It has both slow pick-up and slow drop-away characteristics. Contacts are standard low voltage silver to silver impregnated carbon front and silver to silver back.

### Service Manual Reference

- Refer to **SM 4563F**

### Mounting Base Order No.

- **N438689-001**

| US&S Order Number | Contacts | Description | | | | |
|---|---|---|---|---|---|---|
| | | Coil Resis. (Ohms) | Snub Resis. (Ohms) | Min. D.A. Volts | Max. D.A. Volts | Ener. Volts |
| N322558-701 | 6FB Std. | 66 | 240 | 0.77 | 0.88 | 1.71 |

# Vital Plug-In Relays
## *Code Generating*

### PC-250TR Code Generating Relay

The PC-250TR is a high quality code generating relay. It is used to generate code frequencies for coded track circuits and cab signalling equipment. This relay is tuned to a specific frequency. Its contacts are then used to open or close a circuit at the set rate providing equal off and on times. Two types of contacts are available in the PC-250TR, L.V. (low voltage) and H.V. (high voltage). The L.V. is silver platinum to silver platinum for use in circuits below 50 volts, while the H.V. is tungsten to tungsten for use in circuits above 50 volts, to afford longer contact life. The tungsten contacts cannot be employed in low voltage circuits due to the high contact resistance they develop. The PC-250TR relay must be horizontally separated by at least five inches from the code following relays. However, PC-250TR relays may be mounted adjacent to each other. These relays are not equipped for front testing.

### Service Manual Reference

- Refer to **SM 4569**

### Mounting Base Order No.

- **N438689-003**

| US&S Order Number | Description | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Cycles per Minute | Contact Arrangement | | | | System Voltage | Coil Resis. (Ohms) | Arc Suppr. Res* |
| | | 1 (F) | 2 (B) | 3 (F) | 4 (B) | | | |
| N322556-021 | 50 | L.V. | L.V. | L.V. | L.V. | 10-12 | 60 | 510 |
| N322556-002 | 75 | L.V. | L.V. | L.V. | L.V. | 10-12 | 60 | 510 |
| N322556-005 | 75 | H.V. | H.V. | L.V. | L.V. | 10-12 | 60 | 510 |
| N322556-008 | 75 | H.V. | H.V. | H.V. | H.V. | 10-12 | 60 | 510 |
| N322556-012 | 75 | H.V. | H.V. | H.V. | H.V. | 16 | 90 | 680 |
| N322556-018 | 75 | L.V. | L.V. | L.V. | L.V. | 16 | 90 | 680 |
| N322556-818 | 75 | L.V. | L.V. | L.V. | L.V. | 16 | 90 | 300 |
| N322556-003 | 120 | L.V. | L.V. | L.V. | L.V. | 10-12 | 40 | 300 |
| N322556-006 | 120 | H.V. | H.V. | L.V. | L.V. | 10-12 | 40 | 300 |
| N322556-011 | 120 | H.V. | H.V. | H.V. | H.V. | 10-12 | 40 | 300 |
| N322556-001 | 180 | L.V. | L.V. | L.V. | L.V. | 10-12 | 60 | 510 |
| N322556-004 | 180 | H.V. | H.V. | L.V. | L.V. | 10-12 | 60 | 510 |
| N322556-007 | 180 | H.V. | H.V. | H.V. | H.V. | 10-12 | 60 | 510 |
| N322556-009 | 270 | L.V. | L.V. | L.V. | L.V. | 10-12 | 40 | 300 |
| N322556-010 | 270 | H.V. | H.V. | H.V. | H.V. | 10-12 | 40 | 300 |
| N322556-019 | 270 | H.V. | H.V. | L.V. | L.V. | 10-12 | 40 | 300 |
| N322556-022 | 420 | L.V. | L.V. | L.V. | L.V. | 10-12 | 40 | 300 |
| N322556-016 | 420 | H.V. | H.V. | H.V. | H.V. | 16 | 60 | 510 |

**NOTES**: Energization: Value at which relay will become energized. Response will generally occur at some lower value.
*Internal arc suppressing resistor in multiple with coil.

# Vital Plug-In Relays
## *Code Following*

### Installation Note

**All Code-Following Relays**

All of the relays listed in the Code Following section of this catalog must be horizontally separated at least **5"**- the width of two PN-150 relays or one PN-250 relay. This spacing is designed to prevent magnetic interference between adjacent relays. The five inch space may be filled with any other type of PN-150 or 250 relay, except for the PC-250TR relay.

### PC-250B Relay

The PC-250B relay is a biased relay designed for use as a code-following track or line relay. Two types of contacts are available: low voltage (L.V.) and high voltage (H.V.).

The low voltage is silver platinum to silver platinum for use in circuits below 50 volts, while the high voltage is tungsten to tungsten for use in circuits above 50 volts to assure maximum operational life. However, the tungsten contacts cannot be employed in low voltage circuits due to the high contact resistance that they may develop.

None of the PC-250B relays are equipped with front testing. Refer to the tabulation below for operating specifications.

**Mounting Base Order No.**

- **N438689-003**

**Service Manual Reference**

- Refer to **SM 4570**

| US&S Order Number | Description | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Contact Arrangement | | | | Coil Resis. (Ohms) | Min. P.U. (Amps) | Max. Full Stroke (Amps) | Min. D.A. (Amps) | Min. D.A. (Amps) |
| | 1 (F) | 2 (B) | 3 (F) | 4 (B) | | | | | |
| N322559-003 | L.V. | L.V. | L.V. | L.V. | 135.0 | 0.015 | 0.025 | 0.008 | 10-12 |
| N322559-004 | H.V. | H.V. | H.V. | H.V. | 135.0 | 0.015 | 0.025 | 0.008 | 10-12 |
| N322559-005 | H.V. | H.V. | L.V. | L.V. | 135.0 | 0.015 | 0.025 | 0.008 | 10-12 |
| N322559-008 | L.V. | L.V. | L.V. | L.V. | 0.3<br>400/400 | 0.060<br>0.6 | 0.78 | 0.41 | -- |
| N322559-017 | L.V. | L.V | L.V. | L.V. | 135.0 | 0.015 | 0.025 | 0.008 | 8-12 |

**NOTES**: Energization: Value at which relay will become energized. Response will generally occur at some lower value.

**(Code Following Relays Continued on Next Page)**

## PC-250P Relay

The PC-250P relay is a magnetic stick code following relay designed for transmitting "corrected code". It is operated from a PC-250TR code generating-relay and is controlled through its own contact. This "corrected code" does not change, therefore contact wear on the code generator is compensated or "corrected". Two types of contacts are available in PC-250P relays: low voltage (L.V.) and high voltage (H.V.). The low voltage is silver platinum to silver platinum for use in circuits below 50 volts, while the high voltage is tungsten to tungsten for use in circuits above 50 volts to assure maximum operational life. However, the tungsten contacts cannot be employed in low voltage circuits due to the high contact resistance that they may develop. None of the PC-250B relays are equipped with front testing. Refer to the tabulation below for operating specifications.

### Service Manual Reference

- Refer to **SM 4570A**

### Mounting Base Order No.

- **N438689-003**

| US&S Order Number | Description | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Contact Arrangement | | | | Coil Resis. (Ohms) | Min. P.U. (Amps) | Max. P.U. (Amps) | Appl. Data |
| | 1 (F) | 2 (B) | 3 (F) | 4 (B) | | | | |
| N322559-016 | L.V. | L.V. | L.V. | L.V. | 20<br>20 | 0.031<br>0.031 | 0.035<br>0.035 | -- |
| N322559-014 | N-H. V.<br>R-L. V. | N-H. V.<br>R-L. V. | L.V. | L.V. | 20<br>20 | 0.031<br>0.031 | 0.035<br>0.035 | -- |
| N322559-012 | H.V | H.V | H.V. | H.V. | 180<br>180 | 0.011<br>0.011 | 0.013<br>0.013 | 8-12V |
| N322559-013 | L.V. | L.V. | L.V. | L.V. | 180<br>180 | 0.011<br>0.011 | 0.013<br>0.013 | 8-12V |
| N322559-018 | N-H. V.<br>R-L. V | L.V. | L.V. | L.V | 20/20 | 0.031 | 0.035 | 8-12V |
| N322559-019 | H.V. | L.V. | L.V. | L.V. | 20/20 | .0031 | 0.035 | 8-12V |

**NOTES** Energization: Value at which relay will become energized. Response will generally occur at some lower value.

## PN-150BE Relay

The PN-150BE relay is a high efficiency biased relay used for a front contact repeater to decode a coded track relay. The circuit in which it is used can be designed to provide single stroke immunity, yet remain energized during a code change. The PN-150BE relay can also be operated from a decoding unit. The PN-250BE relay is recommended for application where more contacts are required. Contacts of the PN-150BE relay are standard low voltage silver to silver impregnated front and silver to silver back. Front testing is not available. Refer to the tabulation below for operating specifications.

| US&S Order Number | Description | | | | | |
|---|---|---|---|---|---|---|
| | Contacts | Coil. Resis. (Ohms) | Energization* | | Sys. Voltg. | See Notes |
| | | | Amps | Volts | | |
| N322513-001 | 1FB, 1F, 1B Std. | 60 | 0.0148 | 0.888 | 10 | 1 |
| N322513-002 | 1FB, 1F, 1B Std. | 1000 | 0.0038 | 3.8 | -- | 1 |
| N322521-002 | 1FB, 1F, 1B Std. | 2000 | 0.0033 | 6.6 | -- | 1 |

**NOTE**: * Value at which relay will become energized. Response will generally occur at some lower value.
1- Contacts: 1: FB 2: B 3: F

### Service Manual Reference

- Refer to **SM 4551L**

### Mounting Base Order No.

- **N451376-0302**

## PN-250BE Relay

Like the PN-150BE relay, the PN-250BE relay is used as a front contact repeater to decode a coded track relay. However, the PN-250BE provides extra contacts. The circuit in which it is used can be designed to provide single stroke immunity, yet remain energized during a code change. The PN-250BE may also be operated from a decoding unit. Contacts are standard low voltage silver to silver impregnated front and silver to silver back. Front testing is not available. Refer to tabulation below for operating specifications.

### Service Manual Reference

- Refer to **SM 4563A**

### Mounting Base Order No.

- **N438689-001**

| US&S Order Number | Description | | | | | |
|---|---|---|---|---|---|---|
| | Contacts | Coil. Resis. (Ohms) | Min. D.A. (Front Open) Volts | Energization* | | Sys. Voltg. |
| | | | | Amps | Volts | |
| N322550-703 | 6FB Std. | 55 | 0.57 | 0.0197 | 1.08 | 10 |
| N322550-704 | 6FB Std. | 175 | 1.04 | 0.0112 | 1.96 | -- |

**NOTE** *Value at which relay will become energized. Response will generally occur at some lower value.

# Vital Plug-In Relays
## *Light Out*

### PN-150BL Relay

The PN-150BL is a biased power control relay used for checking lamp filaments. The 3-contact versions of the relay have an internal rectifier that permits main coil operation on both ac and dc lighting energy. The 5-contact PN-150BL relays require an external diode unit. This can be mounted on the rear of the mounting base. The 6-contact relays require an external bridge rectifier, which can also be mounted on the rear of the mounting base. Some PN-150BL relays have a single coil that permits checking of a lighted lamp. Other PN-150BL relays have two coils. One coil is used to check the lamp when not lighted. This is accomplished by applying a dc voltage across the lamp and the 175 ohm coil in series. If the lamp is good, the resulting current will energize the relay, but will not light the lamp.

PN-150BL relay N322526-801 requires an external diode unit. Refer to the ordering tabulation for a diode available for mounting on the rear of the relay mounting base. PN-150BL relay N322528-801 requires an external bridge rectifier. Refer to the ordering tabulation for a bridge rectifier available for mounting on the rear of the relay mounting base.

Front testing is not available with the PN-150BL relays. Contacts are standard (Std.) low voltage silver to silver impregnated carbon front and silver to silver backs. Refer to the ordering tabulation below for operating specifications.

### Mounting Base Order No.

- **N451376-0302**

### Service Manual Reference

- Refer to **SM 6144**

| US&S Order Number | Description | | | | | | |
|---|---|---|---|---|---|---|---|
| | # of Coils | Contacts | Coil. Resis. (Ohms) | Min. Full D.A. (AC Amps) | Energization (AC Amps) | Use with Lamps Req. AC Amps | Notes |
| N322510-801 | 1 | 3FB Std. | 0.18 | 0.18 | 0.7 | 0.85 - 3.0 | -- |
| N322510-802 | 1 | 3FB Std. | 0.70 | 0.08 | 0.35 | 0.40 - 3.0 | -- |
| N322510-803 | 2 | 3FB Std. | 0.30<br>175.0 | 0.18<br>0.01<br>(1.89V) | 0.7<br>0.042<br>(7.35V) | 0.85 - 3.0 | --<br>1<br>1 |
| N322526-801 | 2 | 5FB Std. | 0.30<br>175.0 | 0.18<br>0.01<br>(1.89V) | 0.95<br>0.042<br>(7.35V) | 1.0 - 3.0 | 2<br>1<br>1<br>1 |
| N322528-801 | 1 | 6FB Std. | 17.5 | 0.11 | 0.8 | .25 - .50 | |

**NOTES** Energization: Value at which relay will become energized. Response will generally occur at some lower value.
1- Minimum full dropaway (ac amps) and Energization (ac amps) values: dc calibration. Values shown in parentheses are volts.
2- Relay requiring external diode unit N434909.

Diodes and Bridge Rectifiers:
1. Externally mounted diode for relay N322526-801 can be ordered by US&S part # - N434909
2. Externally mounted bridge rectifier for relay N322526-801 can be ordered by US&S part # N451143-2501

# Vital Plug-In Relays
## *Power Off*

### PN-150P Relay

The PN-150P is an ac operated relay used to detect the presence of ac power and serve as a power transfer device in the absence of ac power. In a typical application, this relay switches equipment over to standby power when primary ac is off.

The PN-150P is a biased relay incorporating a built-in rectifier for ac use. One of its contacts is adjusted to open slightly in advance of the others. This enables the relay to operate with special stick circuits used in power transfer systems (i.e. highway crossing signals). Certain operating conditions such as high resistance in the ac system, in fuse or wire connections, or poor regulation of the transformer supplying the ac load, might cause a sharp rise in ac voltage and thus intermittent opening and closing of the relay front contacts. With the advance opening contact, the relay circuit is opened so that it drops regardless of any changes that may occur in the ac voltage thereafter.

Contacts of the PN-150P relay are heavy duty low voltage silver to silver impregnated carbon front and back. Front testing is available with this relay. Refer to the ordering tabulation below for operating specifications.

| US&S Order Number | Description | | | |
|---|---|---|---|---|
| | Contacts | Coil. Resis. (Ohms) | Energization* (Volts) | Nom. AC Volts |
| N322508-702 | 4FB H.D. 1F/ Std. | 240 | 9.0 | 10 |
| N322508-703 | 4FB H.D. 1F/ Std. | 400 | 10.8 | 12 |

**NOTE** *Value at which relay will become energized. Response will generally occur at some lower value.

### Service Manual Reference

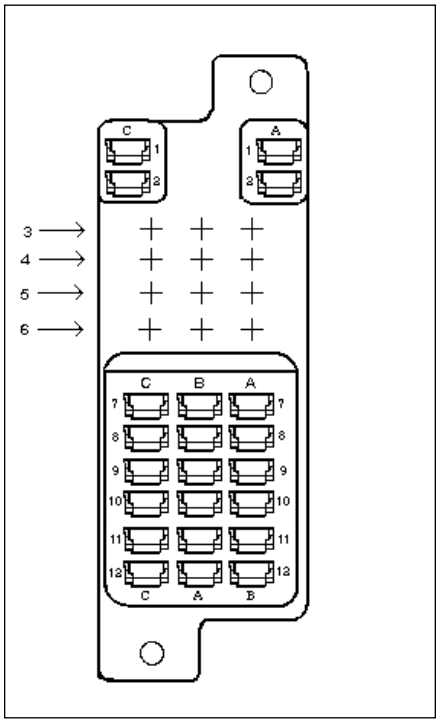
- Refer to **SM 4596F**

### Mounting Base Order No.

- **N451376-0302**

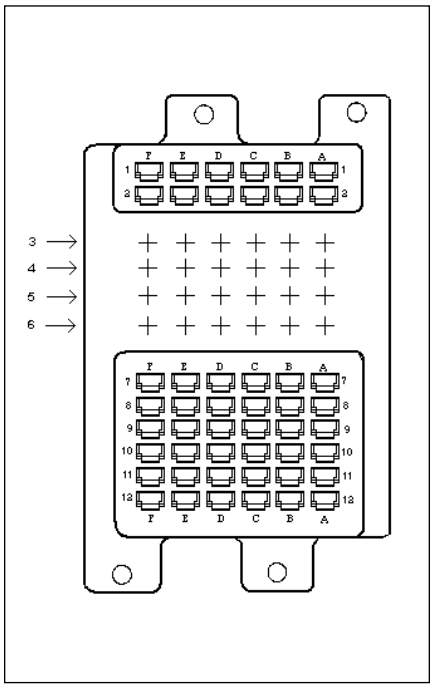
# PN-150/PN-250 Relay Mounting Bases

*PN-150 Series Mounting Base*




*PN-150 Series Mounting Base Indexing (Rear View)*

*PN-250 Series Mounting Base*




*PN-250 Series Mounting Base Indexing (Rear View)*

## Ordering Information

- Refer to each specific relay's ordering tabulations to determine correct base
- Bases and receptacle contact springs listed on next page
- When ordering a replacement for an old style base, refer to the cross-reference indexes on next page

## Service Manual Reference

- Refer to **Bulletin 368**

### General

US&S offers a complete line of mounting bases for PN-150 and PN-250 series plug-in relays. Molded in one piece, these bases have a lower profile than previous bases, yet provide a larger interior cavity for easier wire handling. Ordering references have been reduced to four part numbers each for the PN-150 and PN-250 style bases.

The PN-150 and PN-250 mounting bases are made from long lasting, non-flammable poly-carbonate thermoplastic material. They are constructed in one piece and are only 1-25/32" deep. Although this dimension is less than previous bases, the terminal cavity design provides greater volume. This permits easier wire engagement and extraction, for example, when using a #10-12 contact spring and two #10 wires. New receptacle springs have topside wiring to avoid improper alignments. Maintenance tools used for previous bases can also be used on the new bases.

The PN-150 and PN-250 bases incorporates an improved alpha-numeric nomenclature index that identifies cavity rows and relay contact locations. In this index, a given front is always numbered one less than its corresponding heel, and the heel is always numbered one less than its corresponding back. This matrix also allows quick identification of circuit locations where a circuit board is required on the backs of the base. All PN style relay bases are shipped with a full complement of receptacle contact springs for #14/#16 AWG wire. Contact springs for #10/#12 and #18/#20 wire are also available.

## Old/New Style Base Cross Reference Index

Cross Reference Index - PN-150 Relay Bases

| Old Order No.* | New Order No. |
|---|---|
| N334266 | N451376-0302 |
| N335727 | N451376-0302 |
| N341626 | N451376-0302 |
| N341785 | N451376-0302 |
| N344874 | N451376-0302 |
| N349904 | N451376-0302 |
| N372344 | N451376-0302 |
| N376048 | N451376-0302 |
| N376439 | N451376-0302 |
| N382273 | N451376-0302 |
| N384259 | N451376-0302 |
| N398314 | N451376-0302 |
| N399506 | N451376-0302 |
| N399689 | N451376-0302 |
| N437090 | N451376-0303 |
| N438562 | N451376-0302 |
| N432995 | N451376-0302 |
| N433830 | N451376-0302 |
| N434814 | N451376-0302 |
| N436797 | N451376-0303 |
| N334266-099 | N451376-0301 |
| N335727-099 | N451376-0301 |
| N341626-099 | N451376-0301 |
| N341785-099 | N451376-0301 |
| N344874-099 | N451376-0301 |
| N349904-099 | N451376-0301 |
| N372344-099 | N451376-0301 |
| N376048-099 | N451376-0301 |
| N376439-099 | N451376-0301 |
| N398314-099 | N451376-0301 |
| N399506-099 | N451376-0301 |
| N399689-099 | N451376-0301 |
| N437090-099 | J780055 |
| N438562-099 | N451376-0301 |
| N432995-099 | N451376-0301 |
| N433830-099 | N451376-0301 |
| N436797-099 | J780055 |
| X334266-001 | N451376-0302 |
| X341626-001 | N451376-0302 |
| X344874-001 | N451376-0302 |
| X399689-001 | N451376-0302 |
| X432995-001 | N451376-0302 |

* Reference Only

Cross Reference Index - PN-250 Relay Bases

| Old Order No.* | New Order No. |
|---|---|
| N349769 | N438689-001 |
| N373979 | N438689-003 |
| N374117 | N438689-001 |
| N376442 | N438689-003 |
| N378609 | N438689-003 |
| N382814 | N438689-003 |
| N382816 | N438689-003 |
| N384243 | N438689-001 |
| N385205 | N438689-001 |
| N385788 | N438689-001 |
| N385790 | N438689-001 |
| N386458 | N438689-003 |
| N434647 | N438689-003 |
| N438695 | N438689-003 |
| N434650 | N438689-003 |
| N349769-099 | N438689 |
| N373979-099 | N438689-002 |
| N374117-099 | N438689 |
| N376442-099 | N438689-002 |
| N378609-099 | N438689-002 |
| N382814-099 | N438689-002 |
| N382816-099 | N438689-002 |
| N384243-099 | N438689 |
| N385205-099 | N438689 |
| N385790-099 | N438689 |
| N386458-099 | N438689-002 |
| N434647-099 | N438689-002 |
| N434650-099 | N438689-002 |
| X349769-001 | N438689-001 |
| X373979-001 | N438689-003 |
| X374117-001 | N438689-001 |
| X376442-001 | N438689-003 |
| X378609-001 | N438689-003 |
| X382814-001 | N438689-003 |
| X382816-001 | N438689-003 |
| X384243-001 | N438689-001 |
| X385205-001 | N438689-001 |
| X434647-001 | N438689-003 |
| X434650-001 | N438689-003 |
| X438695-001 | N438689-003 |

* Reference Only

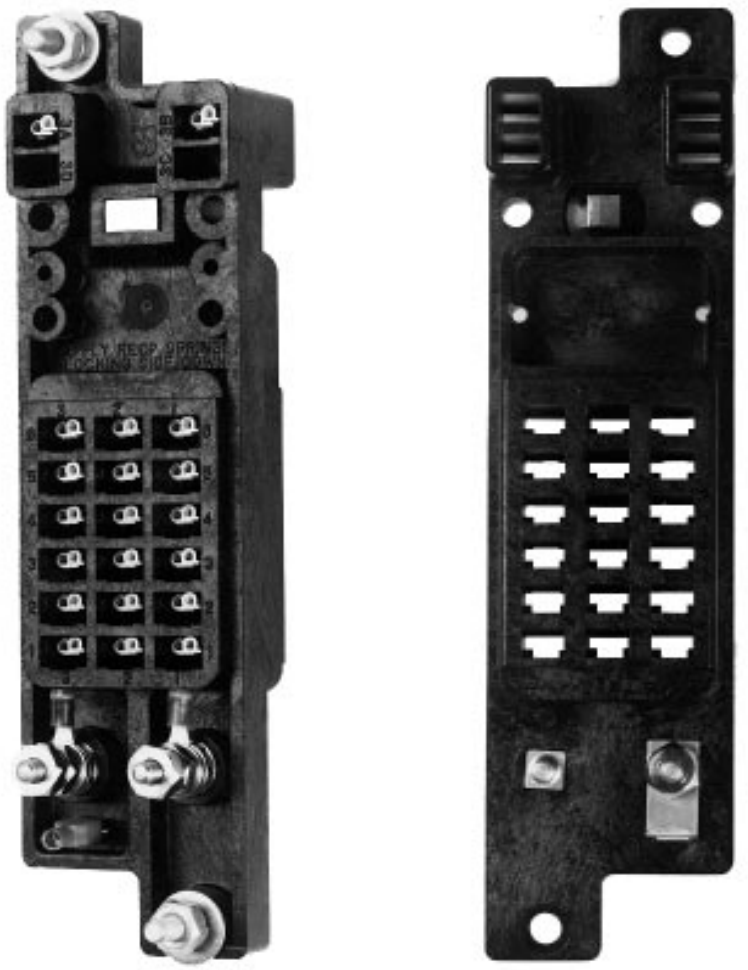
## Contact Springs

| Contact Springs for Old Style Bases | Contact Springs for New Style Bases | Wire Sizes |
|---|---|---|
| J680179 | M451142-2701 | #18-#20 |
| J680165 | M451142-2702 | #14-#16 |
| J680181 | M451142-2703 | #10-#12 |

## Relay Base Ordering Information

| US&S Order Number | Description |
|---|---|
| N451376-0301 | PN-150 mtg. base only |
| N451376-0302 | PN-150 mtg. base, with hardware (#16 contact springs) |
| N451376-0305 | PN-150 mtg. base, with hardware (#14 contact springs) |
| N438689 | PN-250 mtg. base only, latch facing right |
| N438689-001 | PN-250 mtg. base, latch facing right, with hardware |
| N438689-002 | PN-250 mtg. base only, latch facing left |
| N438689-003 | PN-250 mtg. base, latch facing left, with hardware |
| M451142-2701 | Contact receptacle spring, for wire sizes #18/#20 |
| M451142-2702 | Contact receptacle spring, for wire sizes #14/#16 |
| M451142-2703 | Contact receptacle spring, for wire sizes #10/#12 |

# PN-150 Relay Base - *GRS/Safetran Compatible*



***PN-150 Relay Base - GRS/ Safetran Compatible***

## Ordering Information

- Relay bases and receptacle contact springs listed below
- Bases shipped with contact receptacle springs for #14 and #16 wire
- Springs for other wire sizes must be ordered separately
- When ordering a replacement for an old style contact spring, refer to the cross reference index in the PN-150/PN-250 Mounting Bases section of this catalog

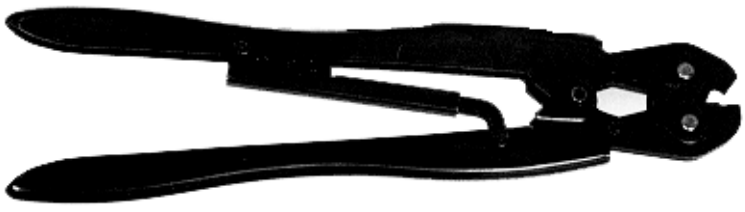
## General

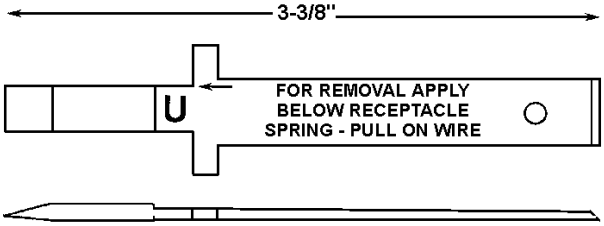
US&S offers a GRS/Safetran compatible plug-in relay base that allows US&S PN-150 series relays to be mounted within GRS/Safetran relay racks. This base allows front testing while the relay is installed. The base is made from a long lasting, flame resistant, dimensionally stable thermoplastic material.

The new base has permanent molded numeric nomenclature to identify columns and rows for relay contact locations, a large receptacle cavity to allow for easy insertion and extraction of relays and contact springs. Its topside contact spring wiring helps maintain proper alignment. The new design also provides for current or voltage testing from the front, without having to remove the relay.

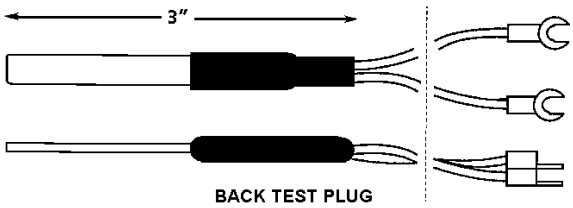
| US&S Order Number | Description |
|---|---|
| N451376-0601 | PN-150 series relay base kit: One base, mounting hardware, tags, instructions, bay of receptacle contact springs for #14 to #16 wire. |
| M451142-2701 | Receptacle contact spring for #18 to #20 wire. |
| M451142-2702 | Receptacle contact spring for #14 to #16 wire. |
| M451142-2703 | Receptacle contact spring for #10 to #12 wire. |

# Receptacle Contact Tools and Test Plugs






FRONT TEST PLUG / EXTRACTION TOOL




BACK TEST PLUG

***Receptacle Contact Tools and Test Plugs***

## Ordering Information

- Crimp tools and test plugs listed below
- When ordering a tool for an old style contact receptacle spring, check cross reference index in the PN-150/PN-250 Relay Mounting Bases section of this catalog

## General

US&S provides quality hand tools for field maintenance of PN type vital relays. Wire-to-wire contact crimping tools are available for each of the three standard sizes of receptacle contact springs. These tools provide precisely directed pressure on the contact to insure a mechanically and electrically sound connection with the wire conductor.

For basic electrical testing of a mounted PN series relay, US&S provides front and back test plugs. These plugs allow contact by contact testing, without disturbing the relay or its wiring. The front testing plug also serves as a contact extraction tool. All of these tools can be used to service old style US&S contact receptacle springs.

| US&S Order Number | Description |
|---|---|
| J397139 | Crimping tool for M451142-2702 contact springs |
| J397138 | Crimping tool for M451142-2703 contact springs |
| J397188 | Crimping tool for M451142-2701 contact springs |
| J772383 | Front test plug/contact extraction tool |
| N322965 | Back test plug |

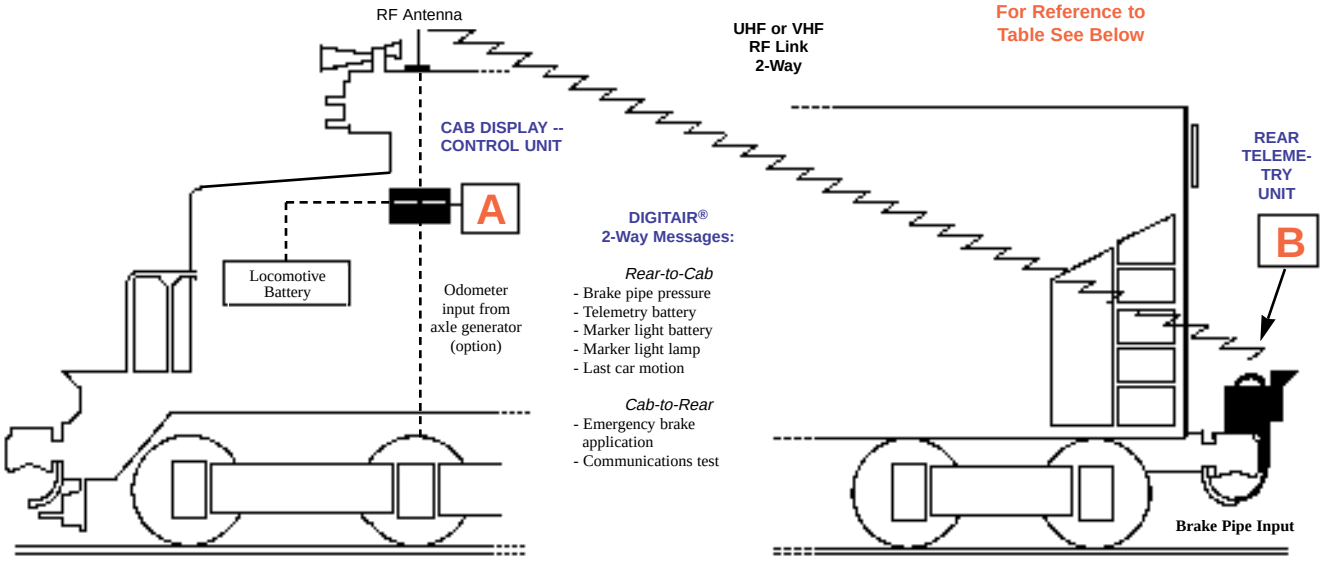
# DIGITAIR® End-of-Train Systems

## General

US&S DIGITAIR® End-of-Train (EOT) systems offer a full selection of "last car" monitoring, control, and equipment protection. These systems may be configured in many ways, basic EOT light protection to an advanced system that can supply crew members with a variety of EOT indications including brake pipe pressure and last car motion. The system also provides the capability to initiate an emergency brake application from the rear of the train.

All DIGITAIR EOT units are built to endure long term use in rugged railroad environments. EOT units are designed to make installation, replacement and servicing quick and simple procedures. Battery powered DIGITAIR devices use a minimum amount of dc power, which helps maximize battery replacement cycles. The DIGITAIR product line is maintained with a wide range of specialized support and test equipment including portable test boxes, PC-based diagnostic software, and battery chargers and analyzers.

The information in the drawing and chart appearing below summarizes the full range of DIGITAIR EOT equipment options. Refer to the pages in this section for details about individual components.




### Features

- Full range of telemetry and non-telemetry equipment
- 2-Way telemetry systems permit last car monitoring from locomotive cab
- Numerous last car monitor functions
- Bright marker light warns approaching trains
- All devices easily installed and maintained
- Long-duration operation of battery-powered units
- Extensive array of service support equipment

**Configuration Guide**

| Ref. | Device | Page | Application | Compatible Device(s) | Comments |
|---|---|---|---|---|---|
| A | 6696 CDU | 9C(1) | 2-Way and 1-Way telemetry | 6695 SBU<br>6651 SBU * | 2-Way application; Switch for rear emergency brake application. |
| B | 6695 SBU | 9B(1) | 1 or 2-Way telemetry | 6696 CDU<br>6624 RDU * | See p. 9C(1) for specifications. |

* For reference only. These retired units have been replaced with Model 6695 SBU on pg. 9B(1) and 6696 CDU on page 9C(1).
SBU = Sense & Brake Unit
STU = Sense & Transmit Unit
CDU = Communication Display Unit
RDU = Receiver Display Unit

UNION SWITCH & SIGNAL

9B(1)
Rev. 5/97

# Digitair® Model 6695 End-of-Train Sense & Brake Unit

## Features

- Modular design makes maintenance fast and easy
- Emergency brake application from the last car of the train
- Compatible with standard EOT batteries
- PC Serial Port for diagnostics, configuration and calibration
- Integral FRA compliant LED Matrix marker light
- Supports one-way or two-way communications
- Reduced battery consumption
- Superior RF Technology based on Modular Transceiver
- Ergonomic, unitized construction
- Supports “Arming” security feature
- Houses optional AEI Tag
- Optional Dual Pressure monitoring capability

## Ordering Information

US&S configures each DIGITAIR® Model 6695 SBU to customer specifications and then assigns special part numbers to each unit. Contact your US&S Sales Representative for detailed ordering information.

## Service Manual References

- Installation & Operation: Refer to **SM 6496**
- Shop Maintenance: Refer to **SM 6497**

## General

The US&S DIGITAIR® Model 6695 Sense & Brake Unit (SBU) is designed to be clamped to the coupler of the last car of a train with its brake pipe sensing hose attached to the train’s brake pipe gladhand.

The SBU mainly functions to transmit to the locomotive operator information about brake pipe pressure at the last car of the train. Other essential data communicated includes the status of the batteries, low brake pipe pressure, motion status of last car, and the integrity of the RF communications link.

All Model 6695 SBUs are equipped to enable an emergency brake application from the last car of the train. Each Model 6695 SBU also features an FRA-compliant, ultra-brilliant High Visibility Marker (HVM) light to warn following train crews within a long range.

Model 6695 is fully compatible with AAR protocol standards for EOT systems and also allows operation with one or two-way devices. Data is transmitted over FCC approved frequencies with unique ID codes and an “Arming” security feature.

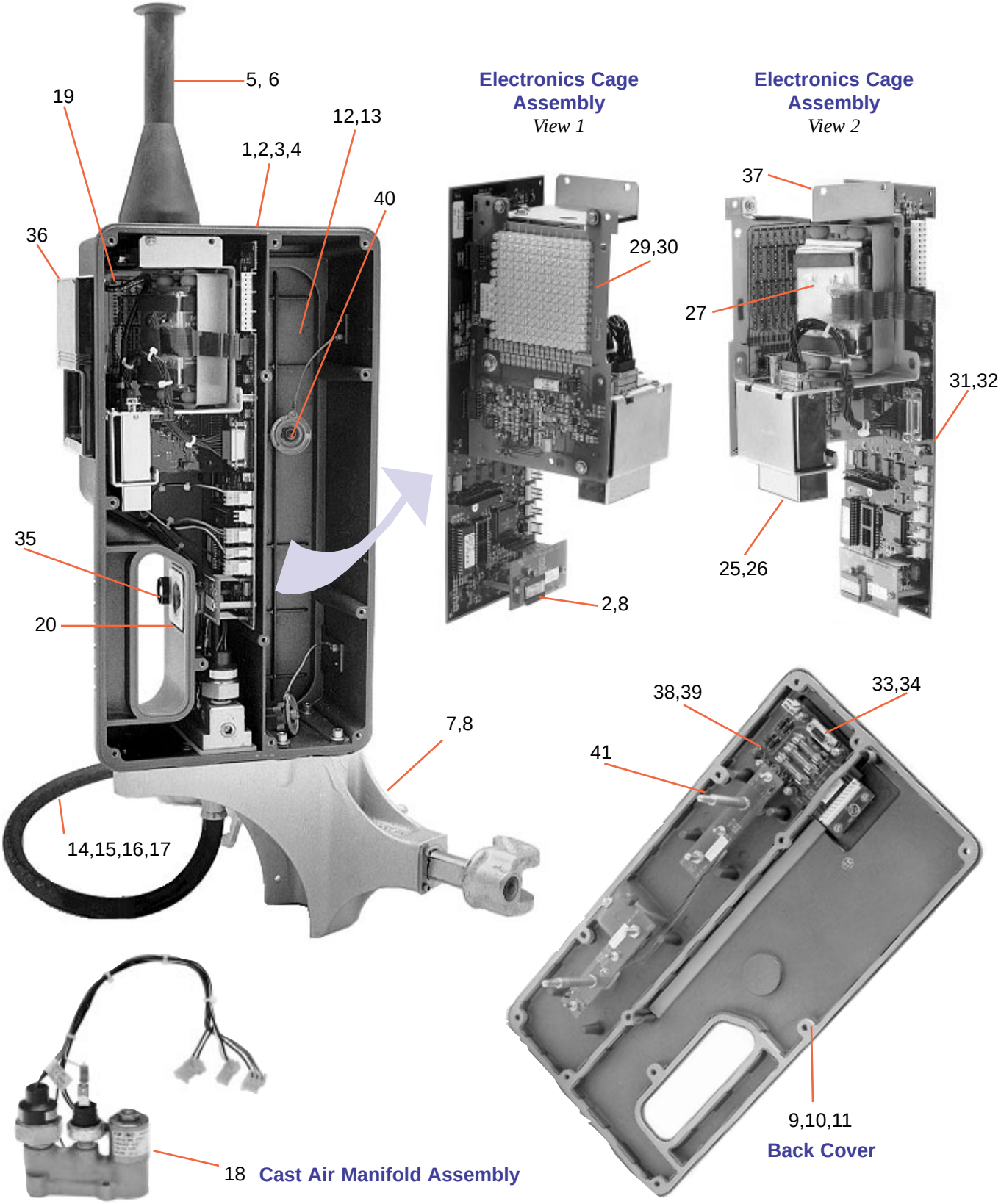
## Unit Mounting and Installation

The SBU’s design makes installation an easy task. A compact but rugged coupler clamp mechanism at the base of the housing allows quick and secure mounting of the unit along with a locking mechanism for security. The Model 6695 has been designed with “Helper Service” in mind. As such, the SBU should be clear of damage from helper locomotives.

The SBU is mounted to the coupler of the last train car by placing its Gripping Jaws into the coupler “guide arm” holes and tightening the handle until the unit is firmly secure. After closing the angle cock on the last train car, attachment to the train’s brake pipe is accomplished by way of the SBU’s brake line sensing hose and integral exhaust valve/gladhand. Once connected, the last car angle cock is opened, allowing brake pipe pressure to be sensed by the SBU. On Dual Pressure Type SBU’s, a second gladhand/hose allows for monitoring another air pressure source.

## Service Features

The SBU features a conveniently placed service door providing access to the unit’s battery compartment, fuses, and an RS-232 serial data port for diagnostics, configuration, and calibration using a standard PC computer. Built-in tests can also be activated using the SBU’s external TEST button.


5, 6
19
12,13
1,2,3,4
40
36
35
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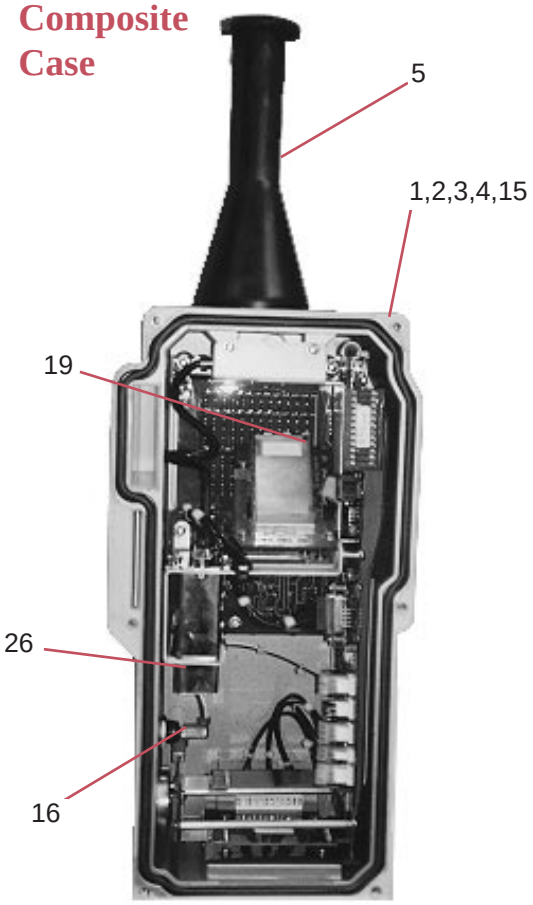
7,8
14,15,16,17
Electronics Cage Assembly
View 1
29,30
2,8
Electronics Cage Assembly
View 2
37
27
31,32
25,26
38,39
33,34
41
9,10,11
Back Cover
18
Cast Air Manifold Assembly

## Commonly Used Spare Parts

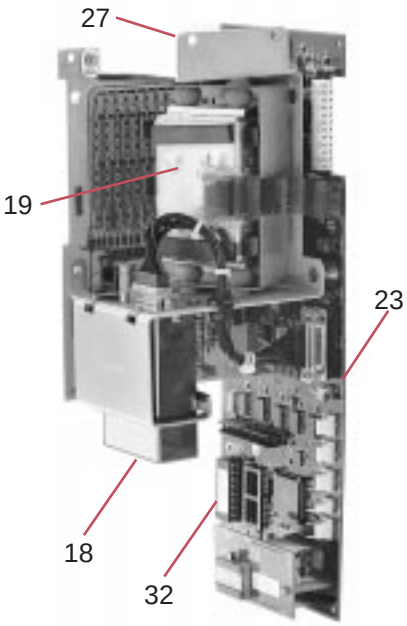
| Item Reference | Part Number | Description |
|---|---|---|
| 1 | N24600403 | Main housing, Nicad battery type |
| 2 | N24606102 | Main housing, VHF sealed-lead battery type |
| 3 | N24608703 | Main housing, lead-acid battery type |
| 4 | M24600802 | Decal, red, reflective, main housing |
| 5 | J793073-0013 | Antenna assembly, UHF |
| 6 | J794002-0006 | Antenna assembly, VHF |
| 7 | N24607701 | Coupler clamp assembly, crank handle (ratchet) type |
| 8 | N24602901 | Coupler clamp assembly, key handle type |
| 9 | N24601801 | Back cover assembly, Nicad battery type, complete |
| 10 | N24609102 | Back cover assembly, lead-acid battery type, complete |
| 11 | N24606801 | Back cover assembly, VHF sealed-lead battery type, complete |
| 12 | M24600602 | Battery door, Nicad type |
| 13 | M24600801 | Decal, red, reflective, battery door |
| 14 | J792426-0017 | Emergency exhaust valve, bottom mounted in-line type |
| 15 | J032760-0050 | Air hose, / glad-hand assembly for in-line type |
| 16 | 148-0207-00 | Emergency exhaust valve for small diameter air hose |
| 17 | J032760-0026 | Air hose, 27", small diameter |
| 18 | N24604101 | Cast air manifold assembly |
| 19 | M24601101 | Lens, marker light |
| 20 | M24601301 | Lens, 4-character led display |
| 21 | J680190-003 | Battery door latch, Nicad type |
| 22 | J561131-0009 | Battery door flexible draw latch, VHF type |
| 23 | 422-0014-00 | Battery door latch, lead-acid type |
| 24 | 440-0039-00 | Wedged support foot |
| 25 | J792741-0014 | Radio, transceiver, UHF |
| 26 | J792741-0022 | Radio, transceiver, VHF |
| 27 | N451873-8001 | Motion, impulse detector module |
| 28 | N451923-4001 | PCB assembly, 4 character LED display |
| 29 | N451923-1601 | PCB assembly, EOT marker light, Nicad type |
| 30 | N451923-1602 | PCB assembly, EOT marker light, lead-acid and VHF type |
| 31 | N451923-1901 | PCB assembly, EOT processor, UHF type |
| 32 | N24700101 | PCB assembly, EOT processor, VHF type |
| 33 | N451923-3401 | PCB assembly, service interface, Nicad type |
| 34 | N451923-3402 | PCB assembly, service interface, lead-acid & VHF type |
| 35 | J725707-0500 | Test switch, push button, SPST |
| 36 | N24601402 | AEI tag holder |
| 37 | N24600102 | Chassis, electronics cage |
| 38 | J710090 | Fuse, 3 amp, 250V |
| 39 | J710021 | Fuse, 2 amp, 250V |
| 40 | 148-0176-00 | Battery Retainer Nut. |
| 41 | 442-0075-00 | Battery Holding Post |

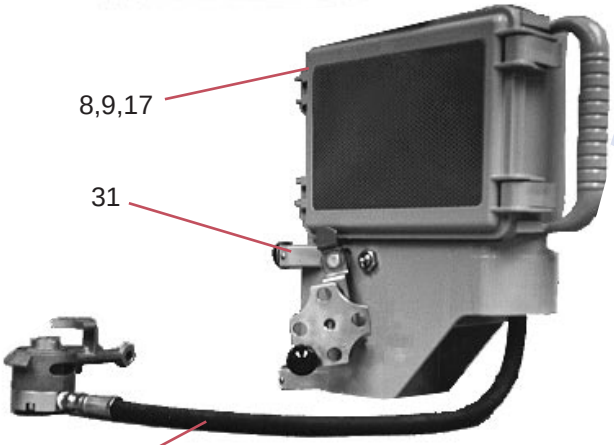
# Model 6695 Composite Case

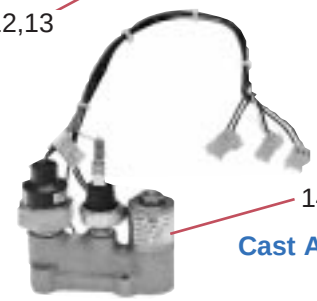



## Electronics Cage Assembly
*View 1*

## Electronics Cage Assembly
*View 2*






Cast Air Manifold Assembly

Back Cover

## Commonly Used Spare Parts

| Item Reference | Part Number | Description |
|---|---|---|
| 1 | N26301201 | Main housing w/door, yellow |
| 2 | N26301202 | Main housing w/door, gray |
| 3 | M24600804 | Decal, red, reflective, battery door |
| 3 | M24600806 | Decal, white, reflective, battery door |
| 4 | M24600805 | Decal, red, reflective, main enclosure |
| 4 | M24600807 | Decal, white, reflective, main enclosure |
| 5 | J793073-0013 | Antenna assembly, UHF |
| 6 | M26300301 | Rear lid, yellow |
| 7 | M26300302 | Rear lid, gray |
| 8 | M24602601 | Jaw, moveable |
| 9 | N24607401 | Crank handle assembly |
| 10 | J792426-0017 | Emergency exhaust valve, bottom mounted in-line type |
| 11 | J032760-0050 | Air hose/glad-hand assy for in-line type |
| 12 | J337385-0002 | Emergency exhaust valve for small diameter air hose |
| 13 | J032760-0026 | Air hose, 27”, small diameter |
| 14 | N24604101 | Cast air manifold assembly |
| 15 | M24601101 | Lens, marker light |
| 16 | M24601301 | Lens, 4-character LED Display |
| 17 | 440-0039-00 | Wedged support foot |
| 18 | N24600007 | Radio, transceiver, synthesized, North America |
| 18 | N24600009 | Radio, transceiver, synthesized, Australia |
| 18 | N24600011 | Radio, transceiver, synthesized, Argentina |
| 19 | N24610101 | Motion sensor |
| 20 | N451923-4001 | PCB assy, 4-character LED display |
| 21 | N451923-1601 | PCB assy, EOT marker light, nicad type |
| 22 | N451923-1602 | PCB assy, EOT marker light, lead-acid type |
| 23 | N24700901 | PCB assy, EOT processor |
| 24 | N451923-3401 | PCB assy, service interface, nicad type |
| 25 | N451923-3402 | PCB assy, service interface, lead-acid type |
| 26 | J725707-0500 | Test switch, push button, SPST |
| 27 | N24600102 | Chassis, electronics cage |
| 28 | J710090 | Fuse, 3 amp, 250V |
| 29 | J710021 | Fuse, 2 amp, 250V |
| 30 | 148-0176-00 | Battery retainer, nicad type |
| 31 | M24607101 | Latch, battery door |
| 32 | N451575-0627 | EPROM, SBU |

## Specifications

| | |
|---|---|
| ***Dimensions*** *(w/antenna)* | H = 37-1/2", W = 14", D = 5" (main housing) |
| ***Weight*** | 23 lbs. |
| ***RF Frequencies*** *(typical)* | SBU transmit frequency = 457.9375 MHz<br>SBU receive frequency = 452.9375 MHz<br>Information on other frequencies is available upon request |
| ***RF Power Output*** | 2W |
| ***Brake Line Pressure*** | Nominal operating range is 0 to 125 psig (measurable) |
| ***PC Interface*** | 9-pin D-Connector, PC-compatible, RS-232 |
| ***Marker Light*** | 1.0 second flash rate, FRA-compliant luminosity |
| ***Battery Life*** | 160 hours typical |
| ***Temperature Range*** | - 40º C to +70º C |
| ***Humidity*** | 95% non-condensing at 40º C / 96-hour exposure |

UNION SWITCH & SIGNAL

9C(1)
Rev. 5/97

# Digitair® Model 6696 Communication Display Unit

## General

The DIGITAIR® Model 6696 Communication Display Unit (CDU) is a self-contained unit that provides all logic and controls for rear-to-front data reception/processing and front-to-rear application of last car brakes in emergency situations. This unit can also be used to receive and display information from a 1-way end unit.

Operating controls are located on the front panel and are arranged for easy use by the locomotive operator. A group of nine illuminated pushbuttons are used to select various menu options. Some of the menu options that can be selected allow the user to set the ID number of the EOTD, select display brightness, select annunciator volume, and several other user definable functions. An audio annunciator is provided to give the user an audio indication when significant events occur.

The Model 6696 CDU has three display areas. A large, three digit LED display is used to display the current brake pipe pressure as measured at the EOTD. A 32-character LED display is used for displaying the current menu item and several items that are useful in EOT configuration and operation. An eight character LED display is used to display the current ID number of the EOTD stored in the CDU and also to display alarm and status information.

A separate optional LED is provided to give positive indication that the CDU is currently armed to an EOTD. Several rectangular annunciators are provided to display information about the status of the EOTD, such as the battery condition, the marker light state, communication status, motion status, and indication of an existing alarm. These indications are used in conjunction with the other display areas to give detailed information in a form that is easy for the operator to interpret and use in the control of the train.

The Model 6696 CDU has the same high level of diagnostics as the Model 6695 SBU. This makes bench troubleshooting very simple and quick. The

## Features

- A wide range of displays monitor the following:
  - Last car brake pipe pressure
  - Brake pipe pressure changes
  - Last car stop, reverse, forward, or moving status
  - SBU telemetry and HVM battery status
  - Communications link status
- Emergency activation of brakes from the rear of the train
- All controls and communications interface circuits in a single unit
- System self-test functions
- Odometer and last car point clearance options

## Ordering Information

- Contact US&S to order component parts, 8W transmitter option and frequency assignment.

## Service Manual Reference

- Refer to
  **SM 7063,** *Installation and Operation*
  **SM 7064,** *Shop Maintenance*

same software used for configuration and diagnostics on the Model 6695 SBU is also used on the Model 6696 CDU. Configuration of the unit is simple and allows the user to select menu items and display items that make operation more efficient.

A protected switch distinctively labeled "EMERGENCY" provides emergency brake applications at the rear of the train. In accordance with AAR guidelines, the CDU supports a security "arming" function to ensure that only authorized commands for rear brake applications are transmitted.

The Model 6696 CDU can be customized to fit any type of installation. The rear connector panel can also be customized to fit any existing plug arrangement making retrofit simple and cost effective.

## Specifications

| | | |
|---|---|---|
| ***Unit Dimensions*** | W= 10.75", H= 4.25", D=8.25" | |
| ***Weight*** | 9 lbs. | |
| ***Mounting Options*** | Mounting tray: 1/4" machine screw holes or AAR clean cab enclosure | |
| ***Operating Power*** | *Typical* | 72V locomotive battery<br>58V (min.)<br>72V (nom.)<br>86V (max.)<br>0.35A (min.)<br>1.5A (max.) current |
| | *Option* | 13.6 Volt<br>13.6V (min./nom.)<br>14.3V (max.)<br>4A current (max.) |
| ***Required Antenna*** | 1/4-wave, whip or low profile type. | |

| | |
|---|---|
| ***Operating Temp. Range*** | +32°F to +140°F<br>(O°C to +60°C) |
| ***Radio Transmitter*** | *Range* 450-470 MHz (UHF) |
| ***Power Options*** | 2W, 4W, or 8W (Transmit) |
| ***Transmitter*** | 452.9375 MHz Typical |
| ***Receiver*** | 457.9375 MHz Typical |
| ***Datalogger Port*** | *Level* EIA RS-232C |
| ***Odometer Interface*** | Compatible with axle generator: 20 PPR or 60 PPR |
| ***Wheel Dia. Calibration*** | 34" (min.), 40" (nom./default), 46" (max.) |

## Commonly Used Spare Parts - *for Models 6656 and 6656A CDUs only*

| Part Number | Description |
|---|---|
| 148-5028-00 | Housing, bottom, AAR clean cab mount |
| 148-0311-00 | Housing, bottom, standard, mounting tray |
| 148-0311-01 | Housing, bottom, standard, mounting tray, CN |
| 148-0012-00 | Housing, top |
| 442-0087-00 | Handle, CDU |
| 443-1620-00 | Front plate, metal |
| 418-0029-00 | Front panel display, standard |
| 418-5003-00 | Front panel display, marked “STU” |
| M451883-1101 | Front panel display, marked “One Way” |
| M451883-1001 | Faceplate, protective, clear |
| 327-0167-00 | Emergency switch guard, red |
| 170-5064-00 | Emergency switch assembly |
| 140-3717-00 | PCB assembly, led display driver board |
| 140-3718-00 | PCB assembly, display processor board |
| 148-5024-00 | Radio transmitter assembly, 2-watt, uhf |
| N451883-0601 | Radio transmitter assembly, 8-watt, uhf |
| 472-0042-00 | Transmitter module, for 2-watt and 8-watt assemblies |
| 472-5000-00 | Radio receiver with Novram, for 2-watt CDU |
| 472-0072-00 | Radio receiver with Novram, for 8-watt CDU |
| 415-0140-00 | Radio receiver cover |
| 148-5020-00 | Rear panel assembly, mounting tray style |
| 148-031-00 | Rear panel assembly, AAR clean cab style |
| 422-0015-00 | Lock latch, slotted, angled, standard |
| J560872-0021 | Lock latch, slotted, straight, CN |
| 443-0725-00 | Lock bracket |
| 443-5086-00 | AAR clean cab mount adapter bracket |
| 140-0640-00 | PCB assembly, DC-DC converter, power supply |
| 140-0706-00 | PCB assembly, modem/logic board set |
| 140-5066-00 | Thumbwheel switch PCB assembly |
| 140-5067-00 | PCB assembly, connector box, rear, twist lock style connectors |
| N451923-0501 | PCB assembly, connector box, rear, MS-threaded style connectors |
| N24700301 | PCB assembly, connector box, rear, CN style connectors |
| 443-5087-00 | Connector box, rear for twist lock connectors |
| N4518831201 | Connector box, rear for MS-threaded connectors |
| N24302601 | Connector box, rear for CN style connectors |
| 443-5088-00 | Thumbwheel security cover |
| 334-0367-00 | Fuse, 2 amps |
| 334-0369-00 | Fuse, 4 amps |

UNION SWITCH & SIGNAL

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# DIGITAIR® System and Component Test Units

## Model 6631 Telemetry Transmission Monitor (TTM)

The device observes RF transmissions from end units in 1-way DIGITAIR® End-of-Train systems. It can be used for routine equipment checks and evaluation of the locomotive engineer's performance.

Non-US&S EOT devices can also be observed if they conform to AAR RF protocols. In addition to brake pipe pressure readings, the TTM also displays End Unit motion detector and telemetry/marker light battery indications (where applicable).

Each TTM is configured with unique software to accommodate the user's system configuration and testing requirements. The TTM will also display brake pipe pressures transmitted by 2-way EOT units.

## Model 6630 Rear Unit Emulator (RUE)

The Model 6630 Rear Unit Emulator provides a convenient means of testing the data reception/processing performance of 1-way RDU cab units. This device can also be used for limited testing of the 2-way model 6656 CDU cab unit.

The RUE is similar to a complete STU in that it generates DIGITAIR®-standard RF, brake pipe pressure, motion detector, and marker light outputs.

The 6630 can be used for final post-installation tests of a cab unit, or for

shop testing of the cab unit. Power is obtained from a NICAD battery or 12 VDC power supply.

### Features

- Detailed Operating and Trouble-shooting Data Provided
- Easy to Connect and Operate

  *US&S's Digitair system and components allow maintainers to perform detailed analysis of EOT systems and major components. These devices feature easy to use controls and indicators and are customized to give function-specific read-outs for different types of DIGITAIR devices.*

### Service Manual Reference

- Refer to **SM 7028**

## Model 6655
## Extended Display Unit

The 6655 EDU allows precise testing of the Model 6651 Sense and Brake Unit, without having to open the housing of the SBU. A 16-character display and five test mode coding pushbuttons perform 15 different key tests ranging from brake pressure response to RF output. Operating power is obtained from the 6651 SBU.

### Ordering Information

Order complete DIGITAIR® test units from the tabulation table below.

| US&S Order # | Description |
|---|---|
| N451861-4117 | Model 6631 TTM |
| 033-0190-00 | Model 6655 EDU |
| 033-0279-00 | Model 6658 RPU |
| N451861-8101 | Model 6677 ATU |
| 033-0020-00 | Model 6625 ADU |
| N451861-3105 | Model 6630 RUE |

## Model 6658
## ROM Programmer Unit (RPU)

The unique ID code for the Model 6651 SBU is programmed with this unit, via a cable connection to the “D” connector port on the SBU. ID code numbers are entered via small numeric thumbwheels. The Model 6658 RPU also allows a technician to read correction voltage values in the SBU transmitter and receiver (e.g. for “curved” radio calibration), and to check SBU battery use.

## Model 6625
## Auxiliary Display Unit (ADU)

This unit performs various tests of the DIGITAIR® Model 6621 and 6635 Sense and Transmit Units, using an external “D” plug connection to the back of the STU’s. Seven different tests are performed using four test mode coding pushbuttons. Easily interpreted test results are displayed on a 16-character LED display. The STU’s provide operating power for the ADU.

## MODEL 6677
## Auxiliary Test Unit (ATU)

The Model 6677 is used to shop test Model 6656. The ATU incorporates four toggle switches which select among 15 test modes, and a momentary-action pushbutton that executes the selected list. Test mode examples include transmitter-on (no modulation), transmit at 1200 and 1800 Hz modulation, receiver-on and arming ID verify. The 6677 ATU requires no separate power supply and is connected to the CDU via the 25-pin datalogger port on the rear of the CDU.

# NICAD Rechargeable Battery

## Features

- Powers DIGITAIR EOT Telemetry Units (NICAD Type)
- High capacity (5.5 Ah typical)
- Long operating life with each change
- Consistent power outputs over wide range of conditions.

## Ordering Information

Order part number 303-0021-00

## General

US&S's Nickel-Cadmium (NICAD) Rechargeable Batteries supply extended operating power for DIGITAIR® EOT devices. The standard battery is suitable for powering intricate radio circuits and powerful marker lights.

Encased in a durable, compact, protective plastic case, each battery incorporates 10 D cells, strapped in series. Locating holes and recessed electrical guide sockets assure that the battery cannot be installed in the reverse polarity position. NICAD batteries are used in the DIGITAIR® EOT devices included in the chart below.

A High Capacity Battery (5.5 Ah) is supplied in a blue colored plastic case and has replaced the lower capacity (4.0Ah) battery which was supplied in a red plastic case.

## Specifications

| | |
|---|---|
| ***Unit Dimensions*** | W = 2.75", H = 2.62", L = 6.58" |
| ***Unit Weight*** | 3.6 lbs. |
| ***Components*** | 10 D Cells |
| ***Capacity*** | 5.5 Ah @ 120 mA Discharge Rate @ +22° C<br>4.25 Ah @ 120 mA Dicharge Rate @ -20° C<br>5.0 Ah @ 1 Amp Dicharge Rate @ +22° C |
| ***Cycling Life*** | 50% capacity after 1000 cycles |
| ***Cycling Level*** | Dicharge to 1.0 Volt/cell after recharge at c/10 for 16 hours @ 22° C |
| ***Operating Temperature Range*** | -40° C to +70° C (NOTE capacity is dependent on temperature) |

| Product Application | Battery Utilization |
|---|---|
| Model 6695 Sense and Brake Unit (SBU) | 1 or 2 battery, telemetry and/or marker light |
| Model 6651 Sense and Brake Unit (SBU)** | 1 telemetry battery<br>3 marker light batteries* |
| Model 6621 Sense and Transmit Unit (STU) ** | 1 telemetry battery<br>3 marker light batteries |
| Model 6635 Sense and Transmit Unit (STU)** | 1 telemetry battery<br>1 marker light battery |

*Single HVM battery option also available for the 6651 SBU.
**For reference only. These devices are no longer produced by US&S.

UNION SWITCH & SIGNAL

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# Model 6629 Battery Charger

### Features

- Services rechargeable NICAD batteries used in DIGITAIR® EOT equipment
- Multiple battery charging in parallel
- Batteries protected during charging

### Ordering Information

- US&S Order No. 304-0001-00. Contact your US&S salesperson for further information.

### Service Manual Reference

- Refer to **SM 7021**

## General

US&S's Model 6629 Battery Charger is a highly productive device for recharging NICAD batteries used in various DIGITAIR® End-of-Train devices.

Up to four batteries can be put under charge at the same time. A full charge is typically attained in five hours, depending on the initial state of the battery.

To improve charge efficiency, the 6629 uses a reverse load charge method. This method sends a pulse charge that interspersed discharge current throughout the charging process. Increased charge efficiency, cooler batteries, and reduced battery "memory" effects are the results.

The 6629 charger provides its user with visual and audible signals to indicate when a charge is complete or when various battery problem conditions (ie: excess battery temperature or "faulty battery") arise. The battery charging process automatically terminates when a problem arises that could damage a charging battery.

Each battery socket is keyed to prevent battery insertion in the reverse polarity position.Although the unit is designed for table top use, wall mounting brackets are an available option.

## Available Retrofit Kit

Contact wear on the nickel plating of the charger/analyzer's spring loaded post may cause an incorrect indication that a good battery is in a failed condition. The worn plating can cause the connection between the battery contact and the spring loaded post to become intermittent.

A replacement parts kit (X24600003) can be installed to remedy misreadings caused by worn plating. The kit consists of four Banana Jack Contact Post Assemblies (J7091460968). These standard banana jack posts will replace worn spring loaded posts.

Each replacement kit contains enough replacement parts to repair one charger/analyzer. Instead of installing the kit on site, the charger/analyzer may be returned to the Union Switch & Signal service shop for repair.

## Specifications

| | |
|---|---|
| ***Unit Dimensions*** | W = 14.25", H = 8.5", D = 9.5" |
| ***Weight*** | 14.6 lbs. |
| ***Operating Power*** | 115V ac, 60 Hz, +/- 15% |
| ***Capacity*** | Up to four DIGITAIR® NICAD batteries |
| ***Current*** | 1.4A (max.) |
| ***Full Charge Detection*** | Negative slope and peak time-out-timer as override (software controlled) |

UNION SWITCH & SIGNAL

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# MICROCAB® Cab Signal System

## General

*US&S's MicroCab® control system represents the next generation of Integrated Cab Signaling (ICS) architecture. It is an open architecture that supports the use of both commercial and proprietary hardware.*

*Precise position, speed, grade and acceleration measurements are obtained from inertial measurement unit technology. Software functions are safely and efficiently handled by US&S's vital software platforms. The system also incorporates digital data radio to accommodate Communications Based Signaling.*

The MicroCab system architecture is built upon a serial bus that supports multi-processor nodes, parallel I/0, locomotive crew flat panel displays, a digital data radio for Communications-Based Signaling, and US&S's Train Inertial Positioning System (TIPS). ATP and ATO functions are provided in the system architecture. Both commercial off the shelf (COTS) and US&S hardware and software are used to implement MicroCab. Input data is encoded for protection with a Global Safety Assurance (GSA) mechanism and is CRC-appended for protection during transmission through the serial bus. The entire MicroCab system is then protected via the GSA mechanism during processing in the CPU, and CRC-protected for digital data radio information transmission.

## Foundation Technologies

The MicroCab system is built upon several cutting edge hardware and software technologies pioneered at US&S, including an advanced vital software platform, an inertial measurement-based positioning technology and a tool set for quantified verification and validation of system safety and performance.

## Vital Software Framework (V_FRAME)

The V_FRAME vital framework is a software driven vital architecture that supports both vital and non-vital tasks as a mixed mode operation. It is based on a flexible, open architecture and industry standards that support both commercial and traditional signaling, software, and hardware technologies. V_FRAME provides the capability for

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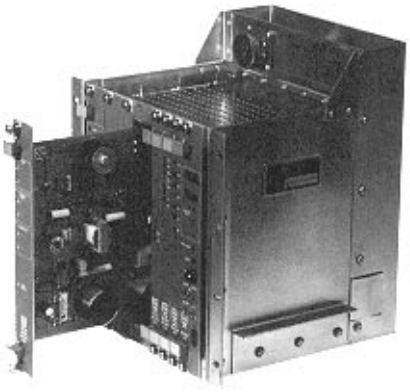
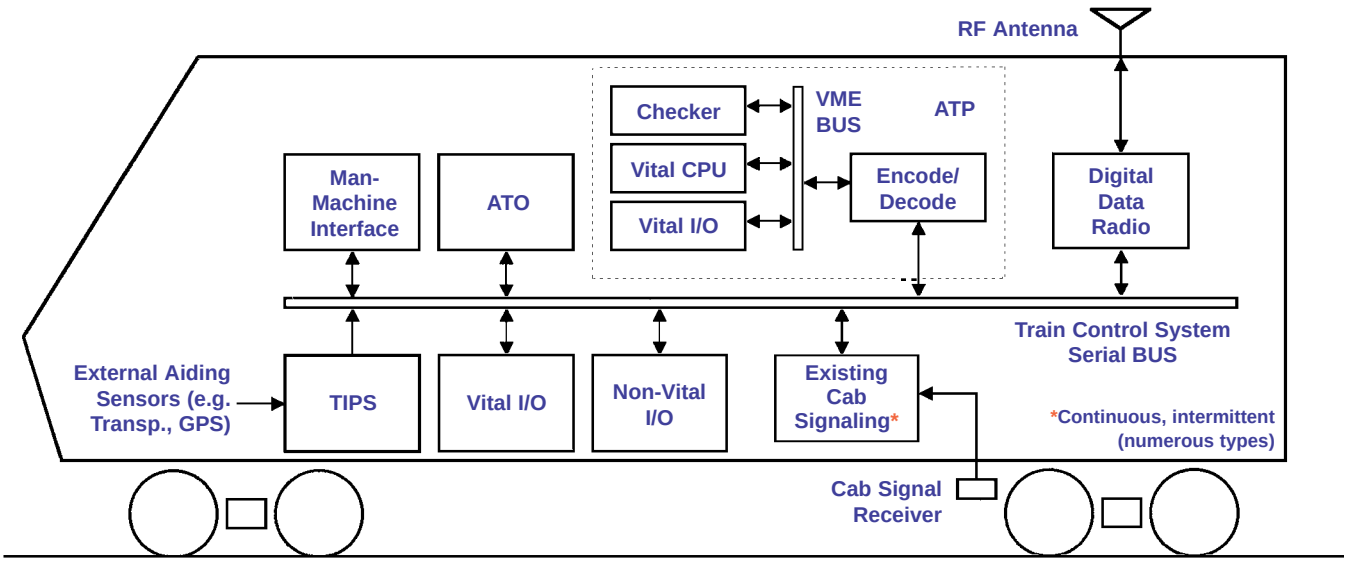


MICROCAB®
CAB SIGNAL SYSTEM

### Features

- Low cost, compact and adaptable
- Interfaces with all CAB subsystems
- Built-in self test and departure test
- Basic to complex Carborne applications



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geographically distributed I/O, multi-processing to enhance performance, along with high speed data transfer among processing and I/O modules.

V_FRAME technology employs checkable object techniques that provide a calculable safety for the complete hardware/software system. System safety is assured using fault containment regions containing simplex processors and the proprietary GSA mechanism, which can be implemented in software or hardware. Key features include:

- Signal engineer oriented graphic-based configuration and programming tools;
- Transparent safety checking mechanisms;
- Quantifiable safety based on checkable object theory;
- Adherence to fault containment regions for each module: Processor, serial bus, I/O, etc.
- ADA compiler minimizes verification and validation of vital run time software, enhance quality;
- Implemented with a strict object-oriented safety critical paradigm

A unique feature of MicroCab is the programmability of the application domain algorithms, with the aid of a Graphic User Builder, that allows vitality to be separated from the implementation of the application algorithms.

## Train Inertial Positioning System (TIPS)

The TIPS subsystem of MicroCab provides highly precise, real-time indications of vehicle position, speed, acceleration and pivotal movements resulting from encounters with track curves and grades. This information is supplied to the MicroCab computer for vital functions such as speed control.

Principal on-board components of TIPS include an inertial measurement unit (IMU), a Digital Signal Processor (DPS) based computer (with vital processor) for integrating IMU data, and auxiliary processing and position/speed-aiding sensor interfaces provided according to the application. Inertial sensor error correction is principally performed by reading track mounted transponders such as US&S's Digitrac, but may also include axle generators, radar, GPS and/or software track map within the DSP.

Software features include a navigator module for rapid integration of IMU data, a "Kalman Filter" module for resolving extremely accurate position indications from the IMU and the external aiding sensor(s), and DSP software written in ADA. Request US&S Bulletin 495A for additional information on TIPS.

## Design for Reliability, Availability, Maintainability, and Safety (D_RAMP)

The D_RAMP tool set performs MicroCab analysis in two important areas: Dependability and Performance. D_RAMP is an integrated environment and underlying design methodology that supports the design and quantitative (rather than purely qualitative) analysis of dependable real-time computing systems such as MicroCab.
The design process is supported from initial concept to final implementation. Initial concepts are in the form of block diagrams and flow diagrams easily developed by the designer. Final implementations consist of printed circuit boards, integrated circuits, workstations and other hardware elements, as well as actual software. The environment supports concurrent design and analysis of hardware and software throughout the design process.

A key component of D_RAMP is integration of the performance and dependability aspects of the system design (e.g. complete MicroCab architecture) into a single model representation. Here, dependability encompasses the metrics of reliability, maintainability, and safety. Performance describes system performance or throughput.

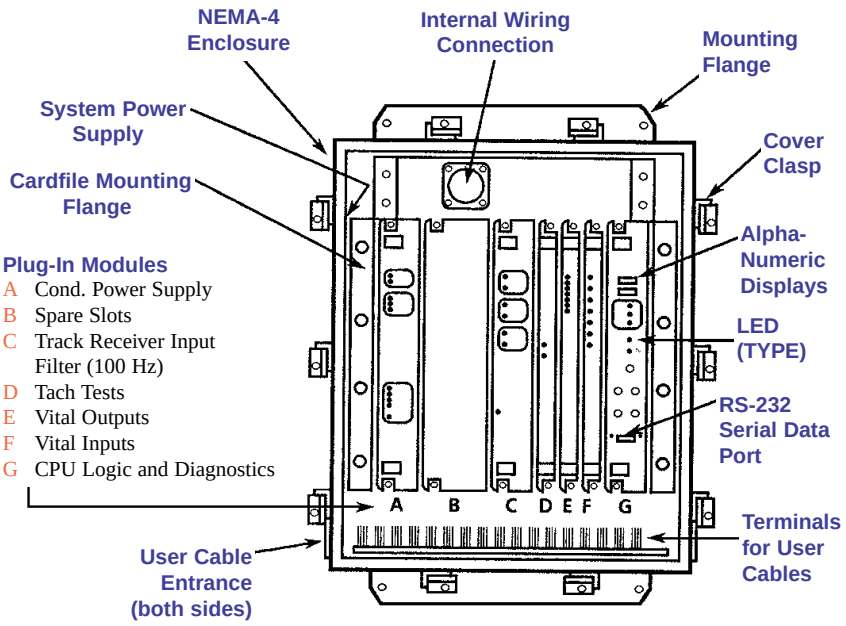
The D-RAMP concept is to model the system with VHDL, Petri Net theory and Computer Aided Engineering tools.

## Sample Specifications - *Basic Cab Signal System*

| | | | |
|---|---|---|---|
| ***Dimensions (NEMA Enclosure)*** | 16-1/2"W x 18"H x 12-1/4"D | ***Vital Outputs*** | 8 channels, max. |
| ***Enclosure Mounting*** | Wall | ***Vital Inputs*** | 8 channels, max. |
| ***Operating Temperature Range*** | -40ºC to +70ºC | ***Microprocessor Family*** | 6809 |
| ***Input Voltage*** | 48 to 88 Vdc | ***System Power Supply Outputs*** | +50 Vdc (power conditioner)<br>+31.5 Vdc (CPS to magnet valve)<br>±12 Vdc, +5 Vdc (power supply) |
| ***Serial Data Port*** | EIA RS-232, RS-485 | | |
| ***Track Rec. Input Filter*** | 100 Hz steady carrier | | |

## Sample Specifications - *CAR "A" / CAR "B" ATP System*

| | | | |
|---|---|---|---|
| ***Dimensions (NEMA Enclosure)*** | 26-1/2"W x 28-1/2"H x 18-1/4"D | ***Operating Temp. Range*** | -40ºC to +70ºC |
| ***Enclosure Mounting*** | Rack mount w/casters for floor handling | ***Code Rates*** | 0, 120, 180, 270, 410 CPM (+2%) |
| ***Microcab Cardfiles*** | Qty = 2 (ATP and ATO) | ***Vital Outputs*** | 8 channels, max. |
| ***Input Voltage*** | 36 Vdc (nom.) battery ground | ***Vital Inputs*** | 24 channels, max. |
| ***Carrier Frequencies*** | 4550 Hz, +69 Hz<br>5525 Hz, +78 Hz | ***Microprocessor Family*** | 6809 |
| | | ***Output Voltage*** | ±12 Vdc (power supply), isolated<br>+5 Vdc (power supply), isolated |




**Plug-In Modules**

- A Cond. Power Supply
- B Spare Slots
- C Track Receiver Input Filter (100 Hz)
- D Tach Tests
- E Vital Outputs
- F Vital Inputs
- G CPU Logic and Diagnostics

## Ordering Information

- Contact US&S if planning for a new cab signal system. This will help ensure the most efficient and cost-effective use of equipment
- Standard plug-in modules and key subassemblies listed below. Order these for in-service systems only (e.g. spares).
- Consult your US&S MICROCAB system service manual for part numbers of specialized modules and misc. components.

| US&S Order No. | Description |
|---|---|
| N451910-0101 | CPU PCB |
| N451910-0102 | Decoder CPU PCB |
| N451910-0801 | Conditional Power Supply (CPS) PCB |
| N451910-0802 | Conditional Power Supply (CPS) PCB |
| N451910-1801 | System Power Supply PCB |
| N451910-0201 | Vital Input PCB |
| N451910-0202 | Vital Input PCB |
| N451910-0203 | Vital Input PCB |
| N451910-0204 | Vital Input PCB |
| N451910-1701 | Vital Output PCB |
| N451910-1704 | Vital Output PCB |
| N451910-1703 | Vital Input/Output PCB |
| N451910-0205 | Vital Input/Output PCB |
| N451910-0206 | Input PCB |
| N451910-0207 | Input PCB |
| N451910-0208 | Input PCB |
| N451910-0209 | Input PCB |
| N451910-1705 | Analog Input PCB |
| N451910-2701 | Interface PCB |

| US&S Order No. | Description |
|---|---|
| N451910-0401 | Tach/Test PCB |
| N451910-0403 | Tach/Test PCB |
| N451910-0205 | Tach-I/0 PCB |
| N451807-4301 | EPROM PCB |
| N451910-3001 | RAM PCB |
| N451910-0501 | Carrier Filter PCB |
| N451910-5101 | EMI Filter/Interface PCB |
| N451910-2601 | Filter/Demodulator PCB |
| N451910-3801 | ASS/ASI Filter PCB |
| N451910-2901 | Dual Filter PCB |
| N451910-3301 | P-Wire Driver PCB |
| N451910-3101 | Multifunction PCB |
| N451910-3201 | Serial Communications Control PCB |

UNION SWITCH & SIGNAL

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# MICROCAB® Shop Test Station

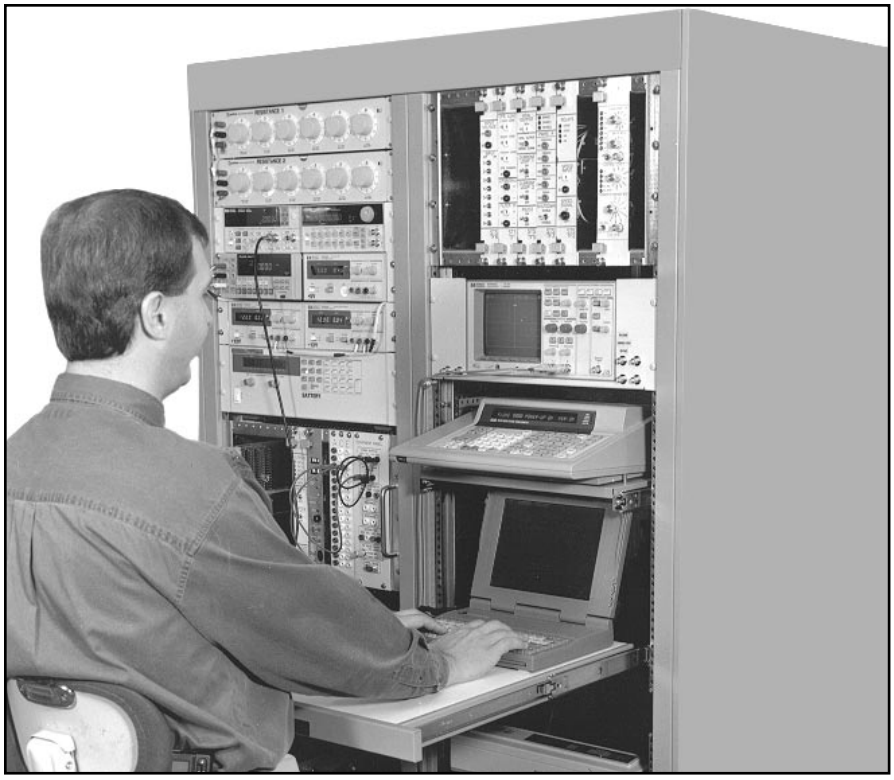
## General

US&S's MicroCab® Test Station (STS) provides all of the latest electronic tools needed to thoroughly check out printed circuit boards used in the MicroCab Cab Signaling System and related subsystems. STS equipment features the leading makers of laptop PC's, micro analyzers, oscilloscopes, function generators, power supplies, etc. These devices are linked with a US&S customized board test fixture to facilitate diagnosis of all types of MicroCab boards, and insure that all testing is traceable to rigid industry standards. User-friendly STS laptop test procedure software is designed to speed the maintainer through the diagnostic process.

## Description

The MicroCab STS enables component-level testing of the full spectrum of MicroCab boards such as CPU, CPS, RAM, Tach./Test, Decoder, Filter, Vital Input, Vital Output and Multi-Function. In addition, the station allows check out of PCBs used in associated equipment such as Aspect Display Units, Trainline Processing Units, and Automatic Station Stopping/ID Systems, as required. Testing of complete MicroCab systems (e.g. ATP) is performed with the US&S Portable Test Enclosure (request bulletin 505b).

The STS consists of two 19" equipment racks integrated into a single workstation with casters for easy handling on the shop floor. Commercial test equipment includes all devices necessary to display test procedures, power the board under test, simulate test input signals, and measure PCB data and power outputs (see next page). The station only incorporates well established brands of test equipment such as Tektronix and HP; new models of the commercial devices are incorporated as they become available. MicroCab Boards under test are installed in a US&S built 6-slot cardfile that provides ample power and I/O connection points between the board under test and the various commercial test units.



Board testing is expedited in the STS six-slot cardfile with convenient "Personality Modules". These modules contain various standard test fixture hardware such as load resistors, toggle switches and LEDs, all arranged for orderly testing of a particular MicroCab board. Other workstation accommodations on the MicroCab STS include a slide-out writing/work surface under the 6-slot test cardfile, slide-out mounting of the micro analyzer, laptop PC and printer, and a drawer for storage of test leads, instrument pods, documentation, etc. PCB testing using the STS is based on initial testing and calibration of the MicroCab CPU board using a dedicated commercial microprocessor analyzer unit. When the CPU is qualified, it serves as the foundation for the remaining MicroCab board tests. This makes the quality of all board testing traceable back to a rigorous industry calibration standard.

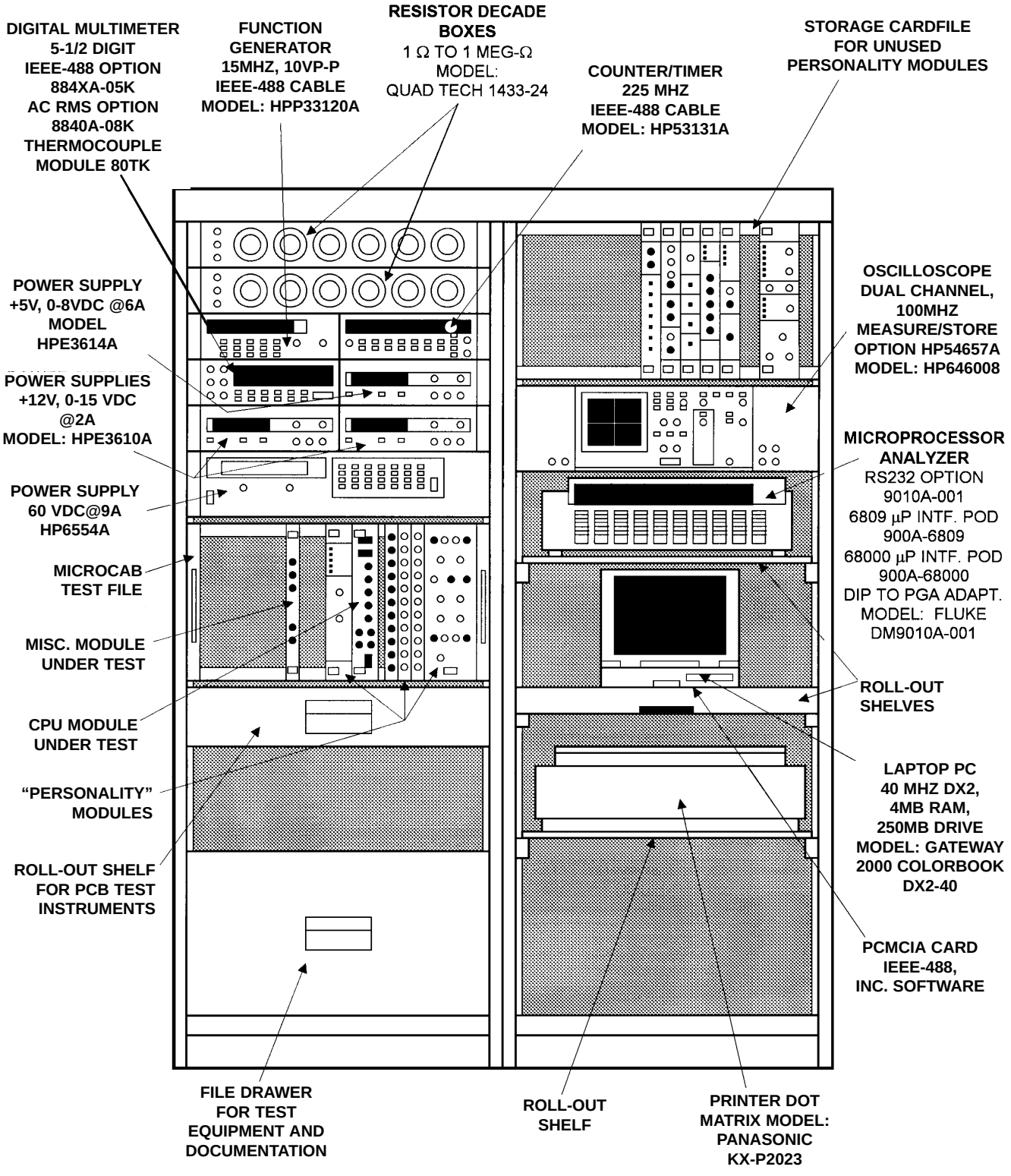
Menu driven test procedures are stored in and displayed on the STS laptop PC, which features a graphical user interface and extensive help files to aid the maintainer (hardcopy procedures are also provided as back-up). US&S's proven "EU" factory test specifications serve as the test procedure source.

## Specifications

| | |
|---|---|
| ***Dimensions*** | 60"H x 38"W x 24"D |
| ***Weight*** | 700 lbs. (approx.) |
| ***Oper. Temp*** | 0ºC to +70ºC |
| ***Oper. Voltage*** | 110-120V ac |
| ***Current Prot.*** | 15A breaker |

## Features

- Complete accommodations for PCB Testing
- Reduces PCB down time and costs
- Helps ensure reliable MicroCab service
- Adaptable to all MicroCab systems
- Simple, PC-based test procedures and control




# MICROCAB® SHOP TEST STATION (STS)

UNION SWITCH & SIGNAL

10C(1)
Rev. 5/97

# DIGITRAC® Train Location System

## General

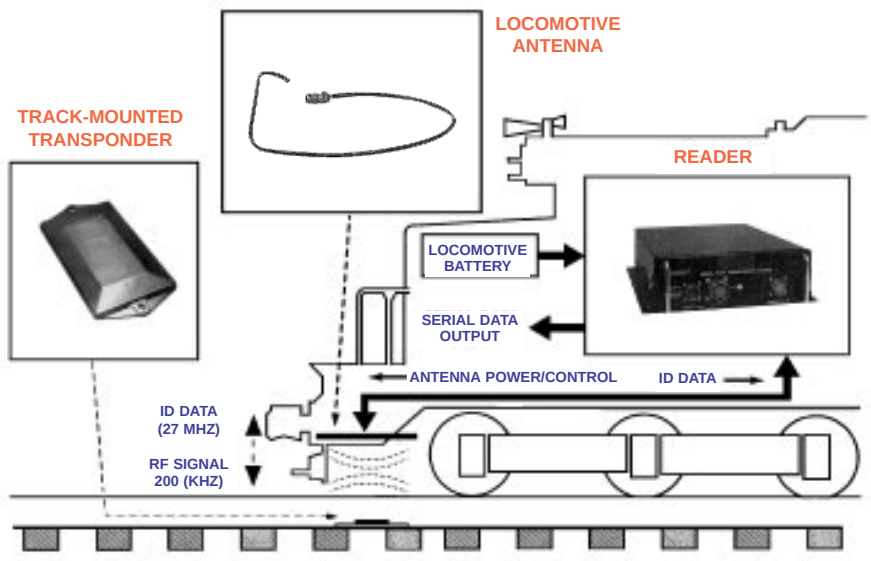
US&S's DIGITRAC Train Location System provides a low-cost, highly reliable means of denoting the position of a moving train, relative to a fixed wayside point. As such, the system affords many valuable applications related to train control. For example, the system can be used for speed control by providing indications to a processor when the train passes successive points of known separation. Or, it can be used for route control (as part of a radio-linked CTC system) to confirm that a train has taken the requested route. The DIGITRAC system conforms to current standards for ATCS applications.

Data transfer occurs at fixed point locations precisely defined by the position of the equipment. While the DIGITRAC system is designed primarily to transfer information from roadbed to locomotive, it can also be inverted to pass information from the vehicle to the wayside. Data is reliably transferred at vehicle-relative speeds up to 100 mph.

Basic components of the DIGITRAC system include a transponder, antenna and reader. The transponder is a fully self-contained, hermetically sealed electronic device that is factory programmed with the user's unique ID code for the wayside location.

Power is obtained through inductive coupling with the passing vehicle antenna. When struck by an unmodulated RF signal from the antenna, the transponder returns its ID code in a modulated signal back to the antenna. Data transfer is totally unaffected by snow, ice, dirt, ambient light, electrical or other RF fields. The tag has ample memory capacity for detailed user ID codes (refer to Specifications).

The low profile DIGITRAC antenna is positioned on the vehicle to scan wayside-mounted transponders as they pass. As commanded by the reader, the antenna continually emits a low-power 200kHz electromagnetic signal and scans for a transponder RF reflection containing the site-specific ID code.




The DIGITRAC Reader controls the overall system and processes transponder codes received through the low profile antenna. This microprocessor-based unit directly interfaces to standard vehicle power supply and is fully protected against various voltage transients. It demodulates and checks the transponder signal for integrity and transfers qualified reads to memory. Data protection is provided by powerful BCH error check coding which virtually eliminates acceptance of erroneous numbers. Validated transponder data is then available for output. The reader is designed to be interfaced to, and communicate with, any standard on-board processor or radio-relay device. Message protocols conform to ATCS standards (refer to "Specifications" on opposite side of this sheet).

DIGITRAC components are designed to withstand use in the difficult railroad environment and are FCC-approved for unlicensed operation.

### Features

- Precise, low-cost position finding for moving trains
- RF-based transponder technology assures highly reliable position reads
- ATCS (335) Compliant
- Readily interfaced to on-board processing equipment
- Designed for the carborne and wayside environments
- All components easily installed and serviced

### Ordering Information

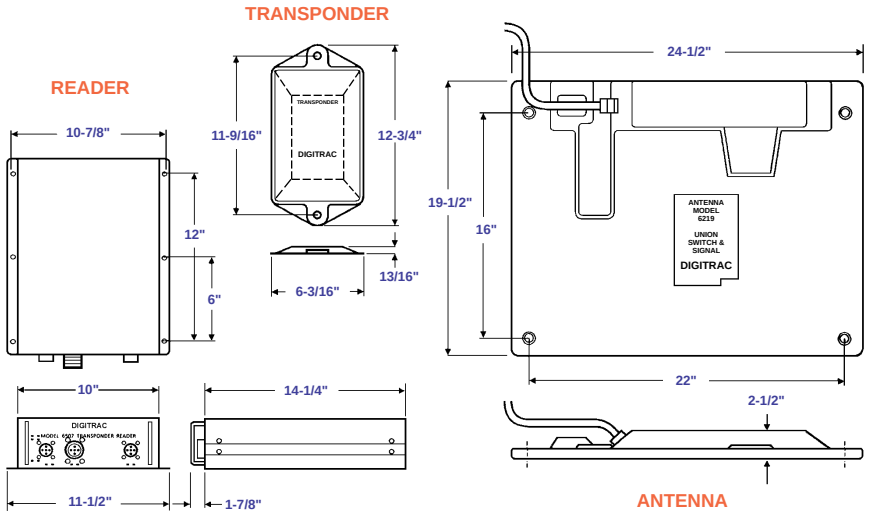
- Contact US&S to order component parts of individual units.

### Service Manual Reference

- Refer to **SM 7018** (ATCS Style) and **SM 7020** (Async Style).

## Specifications

| | |
|---|---|
| ***Component Weights*** | *Transponder* 1 lb.<br>*Antenna* 15 lbs.<br>*Reader* 12.7 lbs. |
| ***Operating Power*** | *Transponder* Inductive coupling 200Hz signal from passing antenna<br>*Antenna* 55 to 85V dc from Reader<br>*Reader* 55V dc (min.), 70V dc (nom.), 85V dc (max.), 0.5A current |
| ***Oper. Temp. Range*** | *Transp. & Antenna* -40º C to +70º C<br>*Reader* -40º C to +55º C |
| ***Vibration Limits*** | *Transponder* 5 - 10 Hz: 7.6 mm P-P.<br>10 - 500 Hz: ± 2.5 gP<br>*Antenna* 5 - 10 Hz: 7.6 mm P-P.<br>10 - 500 H: ± 2.5 gP<br>*Reader* 5 - 10 Hz: 7.6 mm P-P.<br>10 -500 Hz: ± 1.5 gP |
| ***Shock Limits*** | *All three components* 20 gP, 11 mS |
| ***Antenna Signal Transmission*** | Near-field inductive coupling with transponder (complies with FCC Rules, Part 15)<br><br>Power freq.: 190 kHz (min.), 200 kHz, (nom.), 210 kHz (max.) |
| ***Reading Range*** | 10" to 24" (max.) |
| ***Reader Data Interface*** | 1. EIA RS232 ASYNCHRONOUS Serial<br>2. EIA RS422A, serial synchronous duplex (per ATCS Spec. 355, sec. 3.1.2.1, ATCS Spec. 300, App. "O") |
| ***Transponder ID Code*** | *Word Length* 64 bits, including 10 alphanumeric characters |
| ***Antenna Connectors*** | Cannon CA3106-E-18-1P-F80 (model 6219 - flying lead per ATCS Spec. 335) |
| ***Reader Cables*** | *Power* N451883-4001<br>*Antenna Extension* 170-0005-00<br>*Communication* N451805-1701 |
| ***Transponder Signal Transmission*** | Low power HF near-field propagation (compiles with FCC Rules, Part 15)<br><br>RF carrier freq.: 27.247 mHz (min.), 27.255 mHz (nom.), 27.263 mHz (max.)<br><br>Data Rate: 50K BPS |




***Dimensions of the DIGITRAC Train Location System's Reader, Transponder and Antenna***

UNION SWITCH & SIGNAL

10D(1)
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# CDC-10 Cab Signal Decelerometer

## General

US&S's CDC-10 Cab Signal Decelerometer provides a precise vehicle braking rate using new electronics that offer greater capabilities, reliability, and user safety than earlier designs. At the heart of this decelerometer is an electric tilt sensor that is similar to those used in aerospace applications to assure vertical flight. One CDC-10 replaces two slosh-tube decelerometers on a given railroad locomotive or transit vehicle.

## Application

The CDC-10 Cab Signal Decelerometer is a solid-state device designed to measure a vehicle's rate of deceleration and provide a logic output to the cab signal system when a preselected deceleration rate has been exceeded. If the operator fails to brake the vehicle at the minimum required rate, the resulting CDC output to the cab signal system logic results in a penalty brake application.

CDC-10 units are designed for installation in newly installed US&S EH type cab signal systems, but can be retrofitted (with appropriate rewiring) to existing EH systems that already incorporate a slosh tube decelerometer or have an available equipment rack space for the unit. See reverse side for typical wiring application.

## Description

Deceleration measurement via the CDC-10 is done inertially in the same fashion as a pendulum decelerometer. The unit employs an electrolytic tilt sensor to measure deceleration in either direction of travel, thus it can replace two uni-directional slosh tube decelerometers in most applications. Slosh tube decelerometers use a fragile, mercury-filled glass tube that can be easily broken and expose the maintainer to dangerous liquid mercury. Aerospace electrolytic tilt sensors, on the other hand, contain no hazardous materials and are designed to resist severe shocks, g loads and vibrations.

Deceleration rates can be selected over a range of 1.1 to 1.8 miles per second (MPHPS) in increments of 0.1 MPHPS. Other ranges can be calibrated at the factory per customer requirements.

Two models of the CDC-10 decelerometer are provided. One accommodates EH cab signal equipment racks mounted parallel to the vehicle's longitudinal axis to align the tilt sensor to the vehicle longitudinal axis in equipment racks mounted perpendicular to this axis.

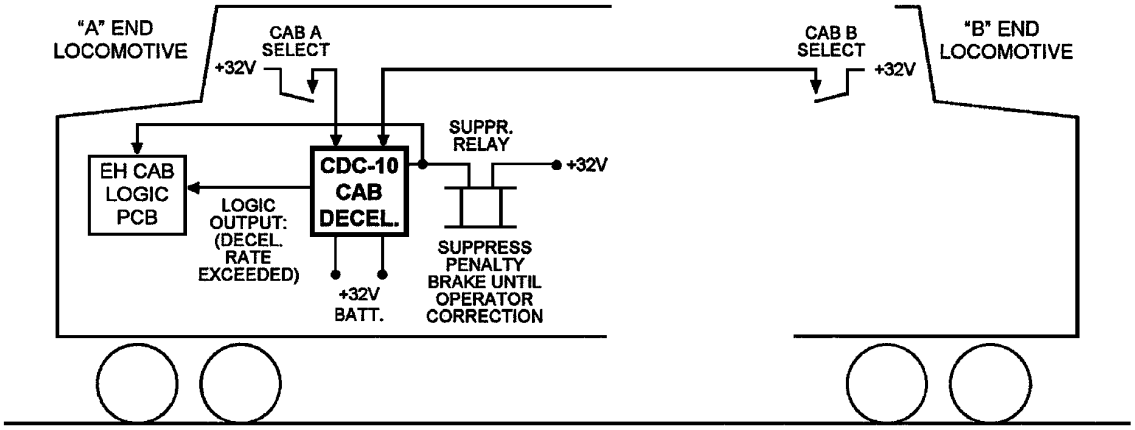
CDC-10 electronics incorporate fail-safe design principles so that a component failure cannot result in the detection of a less than desired brake rate. Components are contained in a single housing that occupies the same rack space as a PN-159B relay or EH cab signal power supply. All electrical connections are made on a standard 8-pin Cinch Jones rack connector. A hinged, clear Plexiglas front access plate (sealable type) allows easy screwdriver adjustment of the tilt sensor for final leveling prior to service (sensor leveling output checked with standard digital voltmeter). The Plexiglas plate also provides access to a single jumper adjustment for the required deceleration calibration. Front panel LEDs and test points enable monitoring of decelerometer outputs.

## Features

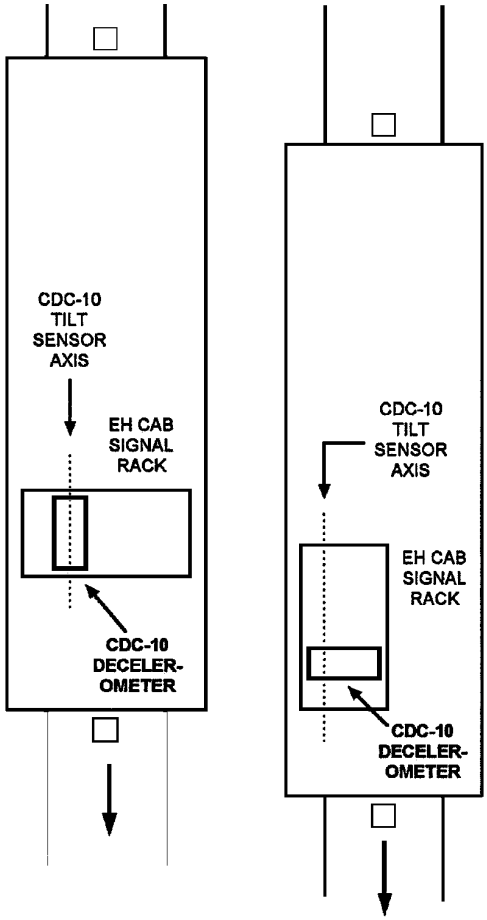
- Bi-directional braking rate measurement
- Field-adaptable braking range selection
- Replaces hazardous mercury slosh tube units
- Parallel or perpendicular mounting to vehicle axis
- Rugged for vehicle environment
- Compatible with all EH Cab Signal Systems

## Specifications

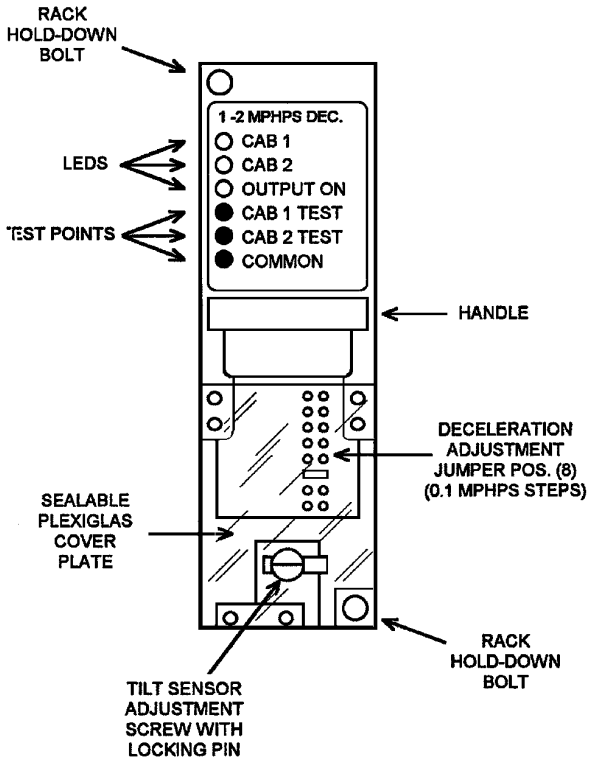
| | |
|---|---|
| ***Dimensions*** | 8.5"L x 8.0"W x 2.5"D |
| ***Weight*** | 6.0 Lbs. |
| ***Mounting*** | Std. EH rack 8-pin plug |
| ***Orientation to Vehicles Axis*** | Parallel or perpendicular |
| ***Sensing Vectors*** | Bi-directional |
| ***Input Power*** | +32 Vdc (nom.) |
| ***Outputs*** | • -23V logic-level (2)<br>• N-V relay drive (1) |
| ***Deceleration Range*** | 1.1 to 1.8 MPHPS |
| ***Deceleration Adjustment*** | 0.1 MPHPS increment |
| ***Operating Temperature Range*** | -40ºC to +70ºC |




**Typical CDC-10 Decelerometer Application. Dual-Cab Transit Train with EH Cab Signal System**



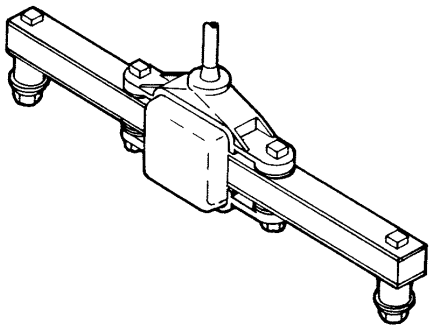

**CDC-10 Decelerometer Tilt Sensor Orientation Options**




**CDC-10 Decelerometer Front Panel Arrangement**

*For additional information on the CDC-10 Cab Signal Decelerometer, call US&S toll-free at 1-800-351-1520, ext. 2004*

# Track Signal Detection - *Track Receivers*



## General

Track Receivers employ two coils, one for each rail, to assure maximum performance over a variety of operating conditions. Weatherproof, heavy-duty construction is used in all components to assure long periods of trouble-free service in the abusive environment under the vehicle.

Each coil is a rubber-encapsulated unit with an integral rigid support. Mounting options include built-in bracket or frame mount type. A weatherproof cable outlet, with pre-wired cable harness assembly, allows quick and easy installation. Each cable harness assembly is terminated in an electrical junction box mounted midway between the receiver coils.

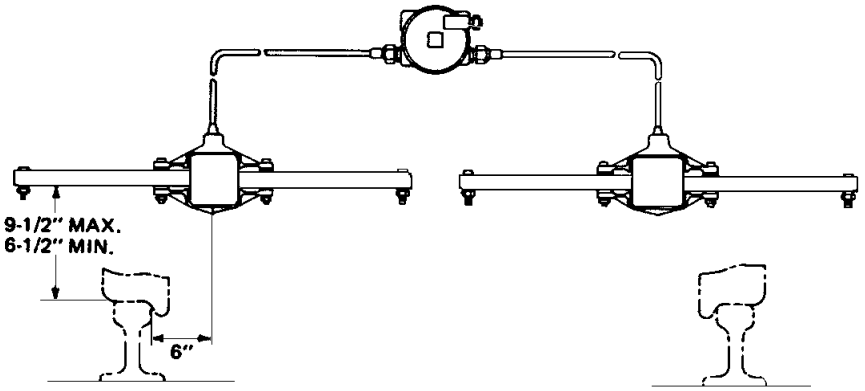
The junction box is equipped with an internal terminal board and pipe tap outlets to expedite electrical connections. Track receivers are available with a full fiberglass enclosure to provide enhanced protection against flying debris.

## Features

- Consistent detection of coded track signals
- Adaptable to all vehicles

## Ordering Information

- Consult your cab signal system manual for applicable order num bers and complete parts listing.
- Common-Use Receivers listed in table below, left
- Contact US&S Sales when ordering for new cab signal systems or to obtain special track receivers that do not appear in the Key Track Receiver Components table below.




## Track Receiver Key Components

| US&S Order Number | Description |
|---|---|
| M199455 | Recvr. mtg. brackets |
| N285017 | Recvr. jnctn. box |
| N285017-001 | Rec. J-Box w/cable grip |
| M451451-0401 | Receiver-to-vehicle gasket |

## Track Receivers

| US&S Order Number | Description |
|---|---|
| X437205 | *Kit* Left & right-hand 30” receivers w/fiberglass enclosures, junction box, cable grips, and mounting gasket |
| X396286-001 | *Kit* Two 30” receivers with junction box and cable grips |
| X396287 | *Kit* Left & right hand 30” receivers with junction box, cable grips, and mounting gasket |
| N396278 | 30” Receiver unit only, with ferrules |

# EH Track Signal Detection - *100 Hz and 60 Hz Filters*

## General

US&S's 100 and 60 Hz filters enhance EH cab system reliability by filtering the carrier portion of the coded signal received from the rails. Each filter uses a set of toroid inductor coils in a metal enclosure.

These units typically provide years of maintenance-free service and require no adjustments. Units are available for shelf (hard wire) or plug-in mounting.

## Features

- Sharp reception of carrier signal in EH systems

## Ordering Information

- Consult your cab signal system manual for applicable order numbers and complete parts listing
- Common-use filter units listed to the right
- Contact US&S Sales when ordering for new cab signal systems or to obtain special filters not listed

| US&S Order Number | Description |
|---|---|
| N451632-0302 | EH 100 Hz filter, shelf mount type |
| N451617-2902 | EH 100 Hz filter, plug-in type |
| N451632-2701 | EH 60 Hz filter, shelf mount type |

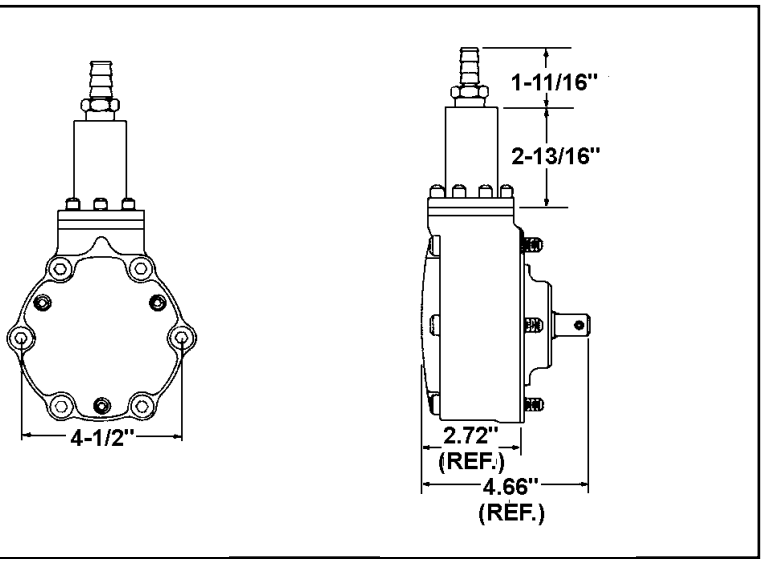
# Speed Detection - *Axle Generator*

## Speed Detection - *Axle Generator*

The axle generator consists of a magnetic pick-up transducer coil within a rugged, cast iron housing. A gear moves in front of the pick-up, causing the coil to produce a signal frequency proportional to speed. The unit is installed in the axle journal box and mechanically coupled to the axle spline to directly monitor axle rotational speed.

A special fitting allows attachment of a rubber hose to the generator wiring to provide additional weather protection. Locomotive-customized adapter plates mount the generator to the journal box cover. Flexible or rigid couplings may be used for the drive shaft connection.

Magnetic transducer J738109 can be mounted on vehicles (typically transit cars) where a speed generator gear is already available. This eliminates the need for the complete generator assembly.




### Features

- Reliable speed signal generation
- Fits all locomotives or transit cars

### Ordering Information

- Consult your cab signal system manual for applicable order numbers and parts listing
- Common-use generator kit and key components listed below
- Contact US&S for new cab signal systems or to obtain special generator equipment that does not appear in listing

### Service Manual Reference

- Refer to **SM 5856**

## Key Components

| US&S Order Number | Description |
|---|---|
| N451125-7003 | Generator unit |
| J725645-0006 | Replacement drive shaft |
| J738109 | Magnetic transducer |

## Axle Generator Kit

| US&S Order Number | Description |
|---|---|
| X451350-1502 | *Kit* Generator<br>Junction box<br>Fitting<br>Bushing<br>Pipe plug<br>Cable grip |

UNION SWITCH & SIGNAL

10H(1)
Rev. 5/97

# On-Board Power Supply
## *F-42 DC/DC Converter and 3-Amp DC/DC Converters*

### Features
- 7.5 Amp output
- Externally mountable

### Ordering Information
- Contact US&S Sales when ordering for new cab signal systems.
- Standard converter unit listed at right.

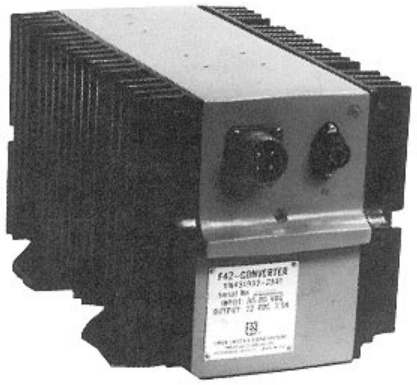
### Service Manual Reference
- Refer to **SM 5924**

### F-42 DC/DC Converter

The F42 is a fully solid-state power supply suitable for cab systems with higher current needs. It converts locomotive battery to regulated 32 Vdc at 7.5 amps continuous current.

The unit employs overload/short circuit protection and starts under a full load. Plug-in circuit boards expedite maintenance, while external plug connection permits easy installation.

The unit is fully weather-proofed for outside mounting (as required) and meets all FRA electrical isolation requirements.



**Specifications**

| | |
|---|---|
| ***Input*** | 60-80 Vdc (64 Vdc nom.) |
| ***Output*** | 32 Vdc @ 7.5 A- 40ºC to + 70ºC |
| ***Starting Capability*** | Four 15W, 34-V signal lamps in multiple resistance load required to bring total load to 240W. |
| ***Overload*** | 11.25 A for 10 minutes @ -40ºF to +140ºF |
| ***Ripple*** | 2.5% max. |

| US&S Order Number | Description |
|---|---|
| N451033-2901 | F-42 DC/DC Converter |

### Features
- Compact, multi-range supplies

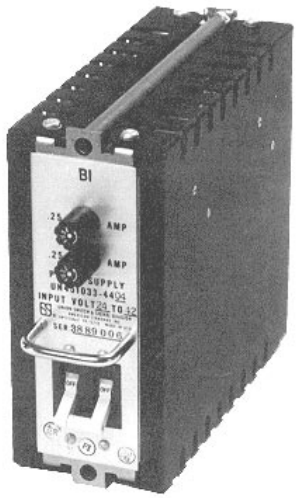
### Ordering Information
- Contact US&S Sales when ordering for new cab signal systems
- Standard converter units listed on next page

### Service Manual Reference
- Refer to **SM 6325** for -4401 unit parts list
- Refer to **SM 6264** for -4402 and -4403 units parts lists

### 3-Amp DC/DC Converters

US&S 3-amp DC/DC power converters can provide both primary and auxiliary output voltages.

Models are available to accept 50-80 Vdc or 77-125 Vdc vehicle battery sources. Output options (nominal) include standard 32 Vdc, 20 Vdc with load or 100 Vdc with load. These supplies meet FRA electrical isolation regulations and are designed for plug-in rack mounting, thereby eliminating the need for a separate mounting space.



| US&S Order Number | Description |
|---|---|
| N451033-4401 | ***Input*** 77-125 Vdc (110 Vdc nom.)<br>***Outputs*** 32 Vdc @ 3.0 A ± 1 Vdc<br>15 Vdc @ 0.5 A, - 1 Vdc, + 2 Vdc<br>20 Vdc w/680 ohm load, 21-24 volts<br>100 Vdc w/6.2K ohm load, 90-120 volts |
| N451033-4402 | ***Input*** 50-80 Vdc (64 Vdc nom.)<br>***Output*** 32 Vdc @ 3.0 A ± 1 Vdc<br>20 Vdc w/680 ohm load, 21-24 volts<br>100 Vdc w/6.2 K ohm load, 90-120 volts |
| N451033-4403 | ***Input*** 24-45 Vdc (32 Vdc nom.)<br>***Output*** (Same as unit N451033-4402 above) |

# Relays: *Non-Vital and PN-159B, PP-151 Vital Plug-In*

## Features

- Magnetic stick relay for vital cab functions
- Designed for the carborne environment

## Ordering Information

- Contact US&S Sales when ordering for new cab signal systems
- Car-carried PP-151 and mounting base listed in table below left

## Service Manual Reference

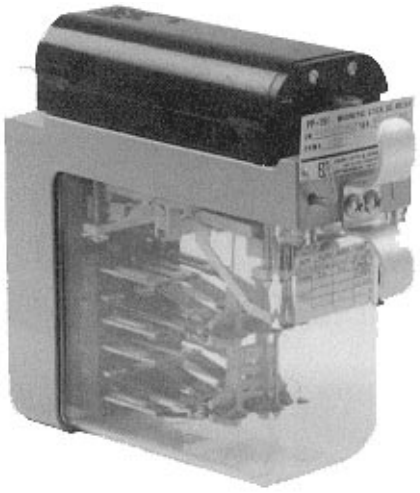
- Refer to **SM 4596-G**

### PP-151 Vital Plug-In

The PP-151 relay holds present state when power is removed. Typical applications include switchover from cab signaled mainline operation to non-signaled yard operation, and system cut-out control.

This PP-151 incorporates six silver to silver impregnated carbon contacts, normal and reverse. Front testing is not available.

Refer to the ordering table for operating specifications and to page 8A(1) for additional information on US&S vital plug-in relays. Wayside versions of the PP-151 are listed on page 8H(1), while



bases for all models of this relay are described on page 8N(1).

| US&S Order Number | Description | | |
|---|---|---|---|
| | Coil Res. (Ohms) | Max. Pick-up & Work. Volts | Min. Pick-up & Work. Volts |
| N437657 | 400/400 | 9.6 | 7.4 |
| N451376-0302 | Mounting Base for PP-151 Relay | | |

### Non-Vital Relay

US&S cab signal incorporates several models of small, non-vital plug-in relays to handle a wide range of functions such as following acknowledge button. These 4DPT relays are available in 24 and 48 volt versions.

## Ordering Information

- Contact US&S Sales when ordering for new cab signal systems
- Standard pressure switch listed in table at right

## Features

- Serves departure test

| US&S Order Number | Description |
|---|---|
| J725707-0066 | From R Contact, Close: 35 psi, Open: 20 psi |

## Features

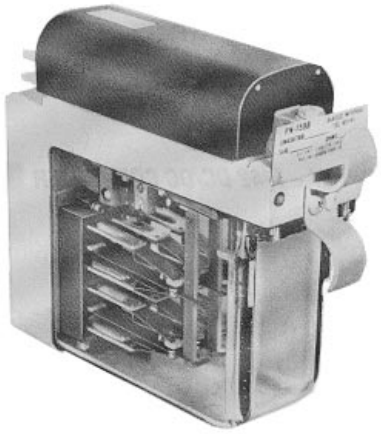
- Biased DC neutral relay for cab functions
- Designed for the carborne environment

## Ordering Information

- Contact US&S Sales when ordering for new cab signal systems
- Standard PN-159B model, mounting base and hold-down bolts listed below
- See page 1A(5) for details of our Relay Remanufacturing Service

## Service Manual Reference

- Refer to **SM 4551-W**



### PN-159B Vital Plug-In Relay

The PN-159B is a double coiled, 24 volt relay with coil resistances of 400/400 ohms. Contacts are 6 front-back, low voltage with silve to silver impregnated fronts and silver to silver backs. Operating options are selected by the configuration of the external wiring.

For example, in selected EH cab signal systems, the coils are connected in series within the connector. This relay can be used for a variety of vital functions such as brake and propulsion control and vital interfacing.

Refer to the ordering table on this page for operating specifications and to page 8A(1) for additional information on US&S vital plug-in relays. Additional data on plug-in bases for these relays is provided on page 8A(1).

| US&S Order Number | Description | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Coil | | Charge Volts | Drop Away | | Full Back Con. Press. D.A. Volts (Min.) | Max. Pick-Up and Working | |
| | Winding A Resistance (Ohms) | Winding B Resistance (Ohms) | | Min. Volts | Max. Volts | | Min. Volts | Max. Volts |
| N436788 | 400 | 400 | 66 | 9.0 | 11.0 | 5.5 | 15.5 | 17.0 |
| N451376-0303 | Mounting base for PN-159B relay | | | | | | | |
| R451299-0102 | Hold-down bolts for PN-159B relay | | | | | | | |

# System Control Equipment

## Test Pressure Switch

### Feature

- Serves departure test

### Ordering Information

- Contact US&S Sales when ordering for new cab signal systems
- Standard pressure switch listed in table below

| US&S Order Number | Description |
|---|---|
| J725707-0066 | From R Contact, Close: 35 psi, Open: 20 psi |

The Test Pressure Switch is installed in most cab systems with departure test capability. It prevents testing when the vehicle's brakes are not applied.

When brake pressure reaches 20 psi (brakes-applied), a pneumatically controlled electrical contact closes. This routes power to the test equipment.

Line pressure decreases to 20 psi, opens the contact, removing this power. The Test Pressure Switch is a sealed and maintenance free unit.

## Vital Time Delay Unit

### Features

- Six to eight second delay on penalty brake application
- Designed for vital cab circuits

### Ordering Information

- Contact US&S Sales when ordering for new cab signal systems
- Standard timer units listed below

### Service Manual Reference

- Refer to **SM 6176**

| US&S Order Number | Description |
|---|---|
| N451489-9001 | Vital Time Delay Unit, 6 to 8 sec. delay |
| N451489-9002 | Vital Time Delay Unit, 4 to 5 sec. delay |

The solid-state Vital Time Delay Unit is available for cab signal applications where a delay is desired between a change of aspect to a more restrictive state and the manual acknowledgement. This prevents premature application of the vehicle's brakes.

The unit is wired to cab signal system logic (input) and a solenoid or magnet air valve (output). When a restrictive signal is received, the cab alarm is sounded, but the unit continues to energize air valve for 6-8 seconds (unit -9001), or to 4-5 seconds (unit -9002).

The air valve opens if an acknowledgement is not received.

## Overspeed Magnet Valve

The Overspeed Magnet Valve translates the vital control of the cab signaling system to the vehicle's brake lines. This magnetic solenoid unit is fitted to an appropriate brake line, and electrically connected to the control system's penalty brake output line. If no action is taken in response to a more restrictive signal aspect, the valve opens to apply air brakes. The Overspeed Magnet Valve is a sealed, maintenance-free unit that incorporates an internal snub.

### Specifications

| | |
|---|---|
| ***Operating Range*** | 20-48 Vdc |
| ***Resistance*** | 84 ohms |

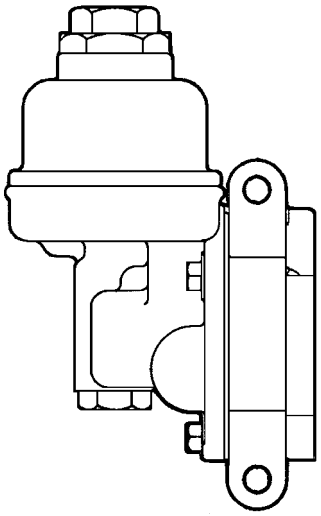
### Features

- Initiates brake application when acknowledged missed
- Designed for vital cab circuits

### Ordering Information

- Contact US&S Sales when ordering for new cab signal systems
- Standard timer units listed below

| US&S Order Number | Description |
|---|---|
| J337164 | Overspeed magnet valve |



## Printed Circuit Boards

Cab signal system printed circuit boards contain circuits for a variety of system functions such as speed sensing and track signal processing, operation of crewman warning indicators, vehicle speed limiting, departure test and interface to an on-board event recorder.

LEDs, test jacks and/or manual adjustments are provided to monitor operation and assist with troubleshooting. All boards are designed and tested to assure reliable operation in the railroad environment.

### Features

- Major system control elements in plug-in form
- Expedite maintenance, upgrades

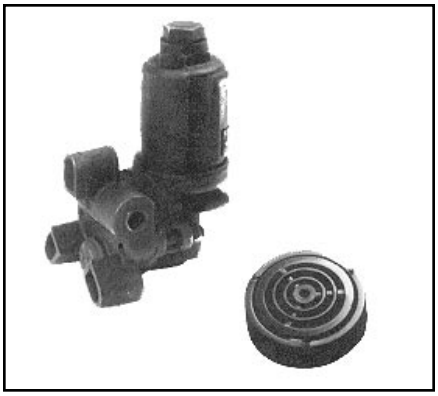
### Ordering Information

- Consult your cab signal system manual for applicable top part numbers and a complete parts listing
- Common-use boards listed in tables on next page
- Contact US&S Sales to order special boards that do not appear in the listing

| US&S Order Number | Description | Function |
|---|---|---|
| N451570-5002 | Shaper-Limiter | Process speed signal |
| N451570-2401 | Shaper-Limiter | See above |
| N451570-1402 | Shaper-Limiter | See above |
| N451653-0701 | Speed Gov. | See above |
| N451653-3102 | Speed Gov. | See above |
| N451570-5101 | Dimmer | Change brilliance of speedometer lamp |
| N451570-3502 | Cab Test | Conducts depart. test |
| N451653-4102 | Cab Test | See above |
| N451653-0601 | Dual Flasher | Flashes acknowledge and overspeed indicators |
| N451570-1601 | 100 Hz Amplifier | Demodulates 100 Hz carrier signal from track |
| N451570-1604 | 60 Hz Amplifier | Same as above, for 60 Hz carrier |
| N451570-1205 | 75 Decoder | Decode 75 CPM track signals |
| N451570-1202 | 75 Decoder | See above |
| N451570-1206 | 120 Decoder | Decode 120 CPM track signals |
| N451570-1203 | 120 Decoder | See above |

| US&S Order Number | Description | Function |
|---|---|---|
| N451570-1207 | 180 Decoder | Decode 180 CPM track signals |
| N451570-1204 | 180 Decoder | See above |
| N451653-2901 | 220 Decoder | Decode 220 CPM track signals |
| N451570-5802 | Acknowledging | Generates restrictive speed change indication |
| N451653-3701 | Acknowledging | See above |
| N451570-1701 | Logic | Processing of inputs from Ack., Shaper-Limiter & Speed Gov. PCBs |
| N451653-2701 | Logic | See above |
| N451570-4202 | Logic | See above |
| N451570-5201 | Slow Pick-up Timer | 60 ± 10 sec. delay on brake relay |
| N451570-8003 | EH Resistor Diode | Snub diodes, drop resistors for NV relays |
| N451570-1101 | Inverter | Back-up power to vehicle battery |
| N451570-5501 | 990 Receiver | Receives coded 90 Hz carrier from rails |
| N451570-1001 | Series Regulator | 28-volt power regulator for PCBs |
| N451570-3302 | Motion Detector | Detects vehicle motion (used with Speed gov. PCBs) |

# Cab Controls and Indicators



## Audible Alarms

Alarms provide audible indication of a change to a more restrictive signal aspect or violation of the authorized speed limit. Options include magnet valve controlled air whistle and electronic alarm (also called “Sonalert”).

The Sonalert is used in selected US&S aspect display units with built-in alarm. It is available as a separate unit for other types of cab installations.

Refer to the ordering table for alarm operating specifications.

### Audible Alarms Features

- Clear report of restrictive speed change or overspeed
- Solid-state or whistle

### Ordering Information

- Contact US&S Sales when ordering for new cab signal systems
- Standard audible alarms listed in table below

| US&S Order Number | Description |
|---|---|
| J700022 | Magnet valve air whistle |
| J705057-001 | Sonalert, 2900 Hz tone, 6-28 Vdc |

### Ackn. Switches Features

- Easy to mount, access and operate
- Models available to suit most applications

### Ordering Information

- Contact US&S Sales when ordering for new cab signal systems
- Refer to your cab signal system manual for related order numbers
- Common use acknowledge controls listed below

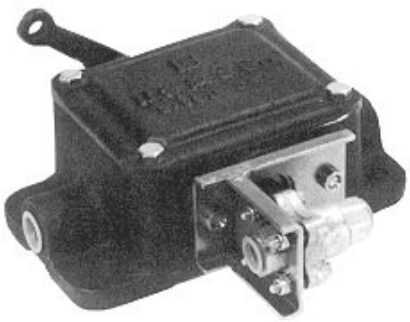
## Acknowledge Switches

US&S provides a wide range of high quality manual switches for cab signal systems where the acknowledgement controls are separate from other cab units. This switch is connected to the vital control logic. Failure of the crewman to actuate the switch within the required time results in a penalty brake application.

| US&S Order Number | Description |
|---|---|
| N451632-3801 | 2-pos. (norm./ack.) spring return lever, lighted type |
| N275155 | 3-pos. (norm./ack./cut-out) spring return lever, opaque type |
| N137633-001 | 2-pos. (norm./ack.) spring return footswitch |

## Main Switch/Cut-Out Cock

The Main Switch/Cut-Out Cock provides master control of the power input to the cab system. Typical uses include entry into non-cab signal territory and manual by-pass in the event of a system fault. To prevent penalty brake applications the device also incorporates a parallel air cock to isolate air from the cab signal equipment. Precision machined pneumatic and electrical components are contained in a heavy duty housing.



| US&S Order No. | Description |
|---|---|
| N102105 | Main Switch & Cut-Out Cock |

### Main Switch/Cut-Out Cock Features

- Contact US&S Sales when ordering for new cab signal systems and for replacement parts

## Speedometer/Aspect Display Units

***Standard Electro-Mechanical Models***

Combination speedometer/aspect display units make it easy to observe vehicle speed in relation to changes in signal aspect. Aspect indicators are located around the perimeter of the speedometer at the established transition points (ie. 15, 30, 45 and 80 mph).

A built-in sonalert alarm sounds when overspeed or a restrictive speed command is received. Departure test, overspeed, cab signal cut-out and associated indicator lamps can also be provided on the display unit.

Related controls include departure test and cab mode levers or knobs, and a speedometer dial/indicator lamp intensity adjustment. A typical array of controls and indicators appears in the table below. Display unit controls, indicators and circuitry are mounted on a common chassis.

A removable face plate permits quick, direct access to all internal components. Power and control signal wiring to the speedometer/aspect display units is typically routed through a 1/4-turn, multi-pin plug receptacle at the housing base.

Standard Electro-Mechanical ADU

***Typical array of controls and indicators consists of . . .***

| | |
|---|---|
| ***Analog Speedometer*** | 10 to 120 mph, back-lit dial |
| ***Aspect Indicators*** | *Upgrade*: red, yellow, yellow/green, green |
| ***VZ (Lamp)*** | Vehicle stopped |
| ***ATC Cut-out (Lamp)*** | Cab signal system disabled |
| ***Depart Test (Lamp)*** | Departure test in progress |
| ***Overspeed (Lamp)*** | Vehicle exceeding authorized speed limit |
| ***Departure Test (Lever)*** | Initiates test of cab signal system before vehicle departure |
| ***Cab Signal Mode (Knob)*** | Engages/disengages system when moving between cab and non-cab territories |
| ***Dimmer (Knob)*** | Adjusts speedometer and aspect lamp intensity |
| ***Lamp Test (Pushbutton)*** | Turns on discrete lamps for test |

### Features

- Vital displays, pushbuttons and audible alarm in a single unit
- Eliminates separate cab control units
- Custom designed for user's needs
- High accuracy, low cost solid state models now available

## Speedometer/Aspect Display Units

***Solid-State Models***

US&S's fully solid-state aspect units provide an unmatched combination of reliability, accuracy, serviceability and low cost. These light weight units feature an all-LED, combination analog/digital speedometer array that eliminates maintenance and accuracy problems associated with mechanical analog speedometers.

As vehicle speed increases, an arc of individual LEDs illuminate sequentially to give the vehicle operator an immediately recognizable "feel" of vehicle speed. MPH/KPH nomenclature around the LED array translate the indication to specific speed values. Working in combination with this LED array is a standard 7-segment, alphanumeric LED readout that shows vehicle speed to the nearest mile or kilometer per hour.

US&S solid state ADUs typically incorporate momentary-action pushbuttons and 2-position toggle switches in the basic mechanical design. These controls can then be used for different purposes, from vehicle to vehicle, according to the user's needs. For example, dual-cab (eg. car A and car B) transit vehicles might use the toggle switches to select same-vehicle or alternate-vehicle control.

Other vehicles might use one of these switches for manual release of automatic cab signal operation. Most all solid-state ADUs employ a pushbutton for automatic departure testing.

Lighted pushbuttons and indicator lamps are also available with solid-state ADUs, allowing operation in darkened areas (eg. tunnels). Intensity of all pushbuttons and LEDs is user-adjustable with one of the momentary-action pushbuttons; four intensity levels are typically provided. US&S solid-state ADUs can also incorporate a standard sonalert alarm as required.

The versatility of solid-state ADUs is made possible with microprocessor-based circuitry. This circuitry allows functional customizing to be done in the software, rather than with the more expensive mechanical components. When required, vital indications such as ATP Fail can be directly controlled (by the external cab signal system) in the event of an ADU power failure. Unlike most electro-mechanical ADUs, US&S solid-state models incorporate a built-in power supply.

Installation and maintenance of solid-state ADUs is simple and cost-effective in comparison with earlier designs. All internal circuitry is contained in several modular circuit boards with plug-type wiring harness connectors.

Connection to the external can signal system (eg. EIA RS-485 serial data port) is typically made with a circular multi-pin connector. The housing design allows mounting flush with a vehicle wall, if required. A complete solid-state design makes these ADUs ideally suited for vibrations and other forces of the vehicle cab environment.

Solid-State ADU

### Ordering Information

- Contact US&S Sales when ordering for new cab signal systems
- Consult your cab signal manual for applicable top part numbers and complete part listing

# Common-Use EL Cab Components - *Track Signal*

## Tuned Amplifier (Receiver)

| US&S Order Number | Description | Service Manual Reference |
|---|---|---|
| N383426<br>N332692 | 100 Hz plug-in unit<br>60 Hz plug-in unit | SM 5682-E Cab System Manual |

## Master Relay

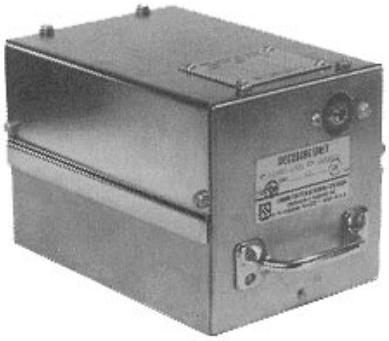
| US&S Order Number | Description | Service Manual Reference |
|---|---|---|
| N326921 | DC Polarized stick, 1F/1B high voltage contacts, 30-ohm coil | SM-5683 |

**Please contact US&S Sales for information about our remanufacturing service**

# Common-Use EL Cab Components - *Decoding*

## Decoding Transformer

| US&S Order Number | Description | Service Manual Reference |
|---|---|---|
| N435483 | Decoding transformer plug-in type | SM-6097 |



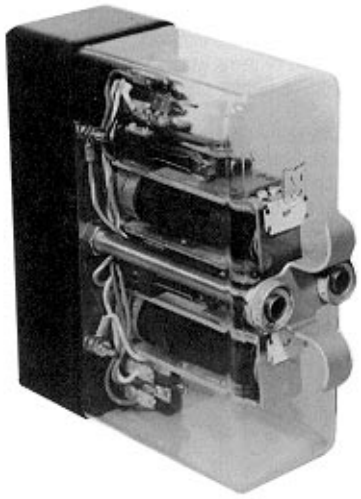
## Tuned Decoding Units

| US&S Order Number | Description | Service Manual Reference |
|---|---|---|
| N451089-8901 | 50 CPM | SM-6096 |
| N451463-0701 | 75 CPM | SM-6096 |
| N451463-0302 | 120 CPM | SM-6096 |
| N451463-0301 | 180 CPM | SM-6096 |
| N451463-0303 | 270 CPM | SM-6096 |
| N451463-0304 | 420 CPM | SM-6096 |

## Untuned Decoding Units

| US&S Order Number | Description | Service Manual Reference |
|---|---|---|
| N451463-0501 | 75 CPM | SM-6097 |

# Common-Use EL Cab Components
## *Vital Plug-In Relays and Bases*



| US&S Order No. | Description | Service Manual |
|---|---|---|
| N273665 | PN-59 dc neutral relay, slow drop-away | 5624-A |
| N265276 | Mounting base for above relays | -- |
| N392637 | PL-59 dc neutral relay | 4559 |

**NOTE** Refer to page 10I(1) and 10I(2) for PN-159B and PP-151 Vital Relays

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